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PROBLEM BASED LEARNING IN MEDICAL EDUCATION:
A QUALITATIVE STUDY OF CURRICULUM DESIGN AND STUDENTS'
EXPERIENCE IN AN EXPERIMENTAL PROGRAM

DISSERTATION

Presented in partial Fulfillment of the Requirements
for the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

Stephen Scott Davis, B.S., M.S.

* * * * *

The Ohio State University

1994

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To my family
in appreciation for their prayers, patients, and positive
encouragement, and for their unconditional love:

Noah, Levi, Noel, Joy, Hope, and, above all,

JULIE

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Finally, and most importantly, I thank and praise God, who renewed my strength daily and divinely intervened through these lives to make me the servant He wants me to be.

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CHAPTER I

INTRODUCTION

The purpose of this research is to understand a problem-based learning curriculum as applied to the College of Medicine at The Ohio State University and to study students' experience within it. The chapter begins with a brief synopsis of problem-based learning and a definition of the term curriculum. Reasons for the study are offered next, followed by the research methodology, research questions, and the boundaries of the study.

Problem-based Learning

Problem-based learning (PBL) herein refers to a curriculum design that uses real life historical problems as a stimulus for students' learning. Students encounter the problem before any prior study and are challenged to determine their current knowledge of the problem and decide what else they need to know to understand the problem. Following the identification of learning needs, students proceed independently to find and study resources and to organize their time in preparation for another cycle of problem encounter, determining current knowledge, and knowledge needs. The cyclic PBL process continues until the

students understand the problem and its underlying causes well enough to move on to a new problem.

Teachers in this design are referred to as facilitators or tutors and play a role of non-directive intervention with responsibilities for organization, atmosphere, administration, focus, stimulation, and evaluation. A small intact group of six to eight students and one or two facilitators serves as the forum for PBL process. PBL is almost completely devoid of any lecture, and the responsibility for learning is the students'.

The heart of this curriculum are the problems, called cases. Cases are locally developed, based on real situations, and authored by the people who encounter the original problem. Case authors work with a team to develop a Problem-Based Learning Module (PBLM) that includes relevant case facts logically ordered over several pages for presentation to the students. The PBLM also provides the facilitators with an abstract, suggested learning issues, suggested timing, and forms for case evaluation. The students, the facilitators, the group, and the problems are the key elements of this curriculum design.

Curriculum Defined

McCutcheon (in press) states that curriculum "mean[s] what students have opportunities to learn under the auspices

of schools: the content the schools offer. Broadly speaking, curriculum concerns *what* should be taught" (p. xvii). She points out that in addition to a schools explicit curriculum, there is an "implicit curriculum . . . inherent in the everyday nature of classroom life" and a "null curriculum . . . consist[ing] of what students do not have the opportunities to learn" (p. xix). These three kinds of curricula are all part of the term "curriculum."

Eisner (1991) asserts that to research and understand a curriculum you must become an educational connoisseur by studying what he calls "the ecology of schooling" (p. 72). The dimensions of this ecology include the intentionally stated goals of the program, the physical structure of the school and classroom, and the curricular dimensions that include actions and activities both seen and unseen (pp. 75-76).

Eisner's (1991) concept of ecology leads to concern about the interrelationship of organisms and their environment. To understand these interrelationships, they must be brought to consciousness through observable qualities that, once perceived, can be expressed. "Learning to see what we have learned not to notice," Eisner says, "remains one of the most critical and difficult tasks of educational connoisseurs" (p. 77).

Need for the Study

Dissatisfaction with traditional lecture and discussion, and progressive knowledge of how people learn, led to the development of the PBL curriculum design. Formulated in 1969 at McMaster University's School of Medicine, this instructional approach is now in use in various forms at over 75 percent of the medical schools in the United States (Jonas, Etzel, & Barzansky, 1989), most Canadian medical schools (Van Vluggen, 1993), and over twenty institutions internationally (Boud & Feletti, 1991).

PBL curriculum design is also promoted by several elite medical education review bodies who have issued a call for less lecture-based learning and more active, independent, self-directed learning. The World Federation of Medical Education, The World Health Organization, and The Network of Community-Oriented Educational Institutions for Health Sciences, as well as The Report of the Project Panel on the General Professional Education of the Physician (GPEP Report) (Berkson, 1992) have all requested change. The growth of PBL is also demonstrated by the recent development of the Problem-based Learning Assessment and Research Centre based in Australia, an electronic bulletin board devoted to PBL (Hadgraft, 1993), and by a bi-annual PBL conference. Clearly there is growing interest in this relatively new curriculum design.

The first research studies on PBL appeared around 1972, and there has been a steady stream of research since. Recently, several meta-analysis studies have been done, each including the English language PBL research data covering the last twenty years (1972-1992). The conclusions of these huge undertakings have a similar ring.

Albanese and Mitchell (1993) note that, "weaknesses in the criteria used to assess the outcomes of PBL and general weaknesses in study design limit the confidence one can give conclusions drawn from the literature" (p. 1). Vernon and Blake (1992) report that "the analysis highlights the need for methodologically rigorous studies that further address the value and effects of PBL" (p. 561). Wolf (1993), in a commentary concerning these studies, summarizes them:

(1) there is a paucity of good-quality studies and evidence available regarding the hypothesis that PBL produces learning and/or learners different from or superior to those derived from traditional approaches, (2) results often are incomplete and poorly reported in the existing primary research reports, (this needs to improve), and (3) there is tremendous need for well-designed, creative primary research-evaluation studies that examine important, clinically relevant behaviors and outcomes (p.544).

With increased attention and use of problem-based learning, many questions arise concerning its utility. PBL represents a wholesale change in the educational process offered by institutions. Change of this magnitude is extremely difficult. The information available from

existing studies is almost entirely derived from quantitative experimental research designs. There are no qualitative studies reported in the literature. A study is greatly needed to investigate problem-based learning from a holistic and naturalistic perspective, identifying and explicating important aspects of the curriculum.

Research Paradigm

A qualitative research paradigm characterized by inductive reasoning is used to address the needs identified above. Inductive reasoning is a type of logical reasoning established by Francis Bacon (1561-1626), who called for a new approach to knowing because the truth of the age was built upon false premises. He believed an investigation should establish general conclusions on the basis of facts gathered through direct observation. Bacon's system included classroom observations resulting in inferences to the whole class (Ary, Jacobs, Razavieh, 1990).

Qualitative research does not assume an *a priori* stance concerning the nature of knowledge. It begins rather with a broad general question that seeks to "make the researched phenomena accessible, tangible, and imaginable" (Glesne & Peshkin, 1992, p. 8). Eisner (1991) says that qualitative inquiry in schools provides the "double advantage of learning about schools and classrooms in ways that are

useful for understanding other schools and classrooms *and* learning about individual classrooms and particular teachers [or students] in ways that are useful for them" (p. 12).

Research Questions

This research addresses two primary questions: (a) What are the important design characteristics of the PBLP curriculum? and (b) What are the key elements of experience for students in the PBLP?

Research Boundaries

Because the focus of this study is on the curriculum design and students' experience, other areas of the PBLP are not fully developed. Creation of case modules and PBLP administration are described only to build a context and aid discussion of how they influence the curriculum design. The literature review is used to understand the context of the study rather than to review any specific questions.

Observations and interviews are primarily confined to one PBLP group while the group is in session. The research is also particular to the College of Medicine PBLP at The Ohio State University. The PBLP curriculum design used at OSU fits Barrow's (1980) model, the one most widely found and used in the literature.

The rest of the study consists of five chapters: (a) the review of literature, (b) methodology, (c) program and participant description, (d) analysis and interpretation of data, and (e) discussions and recommendations. Synopsizing the existing PBL literature is the focus of the review of literature. The methodology chapter provides details about how the study was completed. Physical descriptions of the Problem-based Learning Pathway program and participants are the subject of chapter four, and chapter five contains the description of findings based on data analysis. Finally, chapter six contains a discussion and some recommendations based on the findings.

CHAPTER II

LITERATURE REVIEW

Introduction

The literature review begins by looking to qualitative research authors for guidance on how to proceed.

Qualitative authors do not agree on the timing or usefulness of a review of literature. Glaser and Strauss (1967, p. 37) and Bogdan and Biklen (1992, p. 75) see it as inappropriate for qualitative research because it influences the focus and inductive analysis of a study. On the other hand, Glesne and Peshkin (1992) recommend a pre-study literature review, claiming that the benefits outweigh any possible harm (p.17).

In a mixed view, Patton (1990) initially says a pre-study literature review can help focus the study, but then takes no stand either way. He concludes there are advantages and disadvantages of a literature review done before, during, or after the study (p. 162). Finally, Eisner (1991), who is conspicuously silent about a literature review in his chapter on what makes a study qualitative (Chapter II), says:

Each discipline defines its own interest, employs its own categories, specifies its own aims, and in

so doing, creates its own world (p.28).

The ability to see what counts is one of the features that differentiates novices from experts. The expert knows what to neglect. Knowing what to neglect means having a sense for the significant and possessing a framework that makes the search for the significant efficient (p.34).

Revelation of the particular situation requires, first, awareness of its distinctiveness (p. 38).

Perception of the world is influenced by skill, point of view, focus, language, and framework. What we come to see depends upon what we seek, and what we seek depends ... on what we know how to say (p. 46).

Eisner's assertions to build toward a theory of educational connoisseurship are defined as the ability to "make fine grained discriminations among complex and subtle qualities" (p. 63). One can interpret Eisner to mean that the more that is known about the domain under investigation, the more discriminating one can be at describing what is good, bad, or indifferent. however, Eisner admits that "knowing what to look for can make us less likely to see things that were not a part of our expectations" (p. 98).

Another important consideration must be what makes sense in this setting for this researcher. PBLP is primarily a social group process that is not amenable to identifying and manipulating discrete variables. Approaching the setting void of any understanding of the program would be disadvantageous with regard to knowing what questions to ask and how to ask them. Finally, ignorance of problem-based learning (PBL) hinders the development of a research plan. Siding with the authors who suggest the

benefits outweigh the harm, and after consult with my advisors, I will include a pre-study literature review.

The literature review is not based on a hypothesis or a problem to be solved. It is based rather on the general problem of understanding and identifying PBL's major themes. The process of the literature review is inductive: collecting PBL literature, reading and making extensive notes, coding the notes by major themes, and describing those themes. The review provides advanced organizers and an ability to approach and talk about PBL with its participants. It also provides an overview of PBL which aids the research proposal process.

Overview

Most of the PBL literature comes from the medical community and has been produced in the last three decades, with over 90% in the last seven years. The literature is composed largely of quantitative studies littered with claims, issues, comparisons, theories, and hypotheses. This review helps define PBL and its processes, and highlight pertinent issues.

The literature review defines PBL and provides insight into the impetus behind the PBL movement, the latter being organized into four parts: (a) historical overview, (b) theoretical underpinnings, (c) goals and objectives, and (d)

the real and perceived benefits. This is followed by an outline and discussion of seven major PBL issues: group process, self-directed learning, assessment, facilitator issues, course structure, problem development, and resources. The last section presents a synthesis of several PBL meta-analyses reviews, a summary, and conclusion.

PBL Definition and Model

PBL Defined

PBL is both a curriculum design and an instructional design. Curriculum design refers to *what* is offered while instructional design refers to *how* that material is presented to the students. The distinction between the two is often narrow, and the definition of PBL necessarily includes both. Throughout the study, instructional design is considered as a sub-set of the curriculum design, that is, as an integral part of the PBL process.

PBL is a curriculum design that presents students with a problem from a field of practice as a stimulus for learning (Boud, 1985; Boud & Feletti, 1991, Barrows, 1985; and Barrows & Tamblyn, 1980). Traditional lecture and discussion (LD) learning assumes students must have the knowledge required to approach a problem before they can start on the problem. PBL assumes the need for knowledge;

therefore the knowledge itself arises from work on the problem (Ross, 1991). The difference between the two centers around how content is learned (Barrows, 1985).

PBL is not reductionist, teacher-centered, teacher-directed, subject-based, controlled curriculum. It is, rather, holistic, student-centered, student-directed, problem-based, with an open curriculum (Barrows & Tamblyn, 1980; Norman & Schmidt, 1992).

Diagrammatically, the dichotomy between PBL and LD can be represented by continua with PBL and LD terms at either end of a spectrum (Figure 1). This characterization is seen throughout the literature and is helpful in defining the differences between the

<u>Lecture Discussion (LD)</u>	<u>Problem-Based Learning (PBL)</u>
reductionist-----	holistic
teacher-centered-----	student-centered
teacher-directed-----	student-directed
subject-based-----	problem-based
controlled curriculum-----	open curriculum

Figure 1. Dichotomous Continua between elements of LD and PBL curriculum.

two types of curriculum. One note of caution, however, is heralded by the words of the famous educational philosopher John Dewey (1938) who stated:

Mankind likes to think in terms of extreme opposites. It is given to formulating its beliefs in terms of *Either-Ors*, between which it recognizes no intermediate possibilities. When forced to recognize that the extremes cannot be acted upon, it is still inclined to hold that they are all right in theory but that when it comes to practical matters circumstances compel us to compromise (p. 17).

Classic PBL Model

Classic PBL as outlined by Barrows and Tamblyn (1980) is designed for small groups of five to seven students with one or two tutors or facilitators per group. The model has six steps:

1. The problem is encountered first in the learning sequence, before any preparation or study has occurred;
2. The problem situation is presented to the student in the same way it would be presented in reality;
3. The student works with the problem in a manner that allows his ability to reason and apply knowledge to be challenged and evaluated, in a way appropriate to his level of learning;
4. Needed areas of learning are identified while working with the problem and are used as a guide to individualized study;
5. The skills and knowledge acquired by this study are applied back to the problem, to evaluate the effectiveness of learning and to reinforce learning; and
6. The learning that has occurred in work with the problem and in individualized study is summarized and integrated into the student's existing knowledge and skills.

The model is holistic, considering patient and community needs, not just a single disease state or body system. It is also student-centered and student-directed emphasizing learning. Students identify their learning needs, develop a plan to satisfy them, and assess their own progress. Finally, it is open (interdisciplinary) and problem-based, with learning focused on understanding. However, like other widely adopted models, each PBL program varies.

Barrows (1986) develops a taxonomy (Table 1) on the most common types of PBL methods and rates their effectiveness on a scale of one to five, five being best in relation to the structuring of knowledge (SCC), clinical reasoning process (CRP), effective self-directed learning skills (SLD), and increased motivation for learning (MOT).

Table 1
Barrows Taxonomy of PBL Methods

<u>Method</u>	<u>SCC</u> ^a	<u>CRP</u> ^b	<u>SLD</u> ^c	<u>MOT</u> ^d
Lecture-based cases	1	1	0	1
Case-based lectures	2	2	0	2
Case method	3	3	3	4
Modified case-based	4	3	3	5
Problem-based	4	4	4	5
Closed-loop problem-based	5	5	5	5

Note. a. Structuring of knowledge (SCC)
 b. Clinical reasoning process (CRP)
 c. Effective self-directed learning skills (SLD).
 d. Increased motivation for learning (MOT)

Note. From "A taxonomy of problem-based learning methods" by H. Barrows, 1986, Medical Education, 20, p. 483

Like the difference between PBL and LD, these different PBL methods can be seen as continua from near total teacher control to near total student control of the learning. Of course, in any method, the skill of the teacher and the evaluations used greatly affect learning outcomes (Barrows, 1986). Barrows says the closed loop or reiterative PBL method, while being the best method to address qualitatively specific educational objectives, is also the most complex, time intensive, and costly to develop. That is, "the methods with the greatest educational potential are also the more difficult and expensive to mount" (p. 485).

In sum, PBL is a curriculum design using problems to engage students in self-directed learning. By encountering problems before any theory or practice, the students must take responsibility for their own learning. While the design and implementation of each PBL curriculum, track, or course is unique, the aspects outlined herein are considered the defining aspects of a problem-based learning curriculum.

Impetus Behind the PBL Movement

Historical Overview

At the heart of the PBL movement are two very strong drivers of human actions--attitude and knowledge. The prevalent attitude is dissatisfaction with the traditional

lecture and discussion model (Foster & Gilbert, 1991; Hurley & Dare, 1985; Macadam, 1985; Neufeld & Barrows, 1974; and Schwartz, 1991). This general dissatisfaction stems from hindsight realization by students, faculty, and administrators that learning in everyday life is easy, fun, motivational, continuous, and natural; but the same activity in a classroom becomes arduous and boring, not like learning in our daily world. (Dewey, 1938; Eisner, 1982).

In Barrows' (1985) seminal work on PBL, he discusses reasons why PBL is necessary. He relates his dismay in finding a "paucity of basic knowledge" in the students he taught. "I knew," he said, "that these students had been exposed to, and had passed, excellent, detailed courses" (p. ix).

The second major PBL driver is the knowledge of current understanding about how people learn. Research on learning theories contains evidence that renders the current pedagogical model of lecture and discussion poor at taking advantage of how people learn (Gagne, 1987). As a result of these factors, PBL was developed about thirty years ago and is currently experiencing unprecedented growth (Van Vluggen, 1993).

While learning from problems is a popular classroom strategy, using a curriculum design that consists of nothing but problems without prior study is PBL's unique attribute.

PBL was established in 1969 in conjunction with the establishment of the new Faculty of Medicine at McMaster University, Hamilton, Ontario Canada. Now dubbed the "McMaster Philosophy", PBL was conceived as a curriculum placing emphasis on building specific capabilities and characteristics in the individual student-physician, rather than building a store of knowledge (Neufeld & Barrows, 1974). The framers were motivated by dissatisfaction with the medical education of their era and subsequently began an experimental curriculum that has been growing in volume and popularity since.

Over the years, McMaster's disciples have slowly encouraged other schools to adopt PBL. A major boost for PBL came in 1984 when the Report of the Project Panel on the General Professional Education of the Physician (GPEP Report) called for less lecture-based instruction and more emphasis on independent learning and problem solving. Produced by medical educational professionals, this report recognized the need for drastic changes in medical education. Specifically, the GPEP report stated:

[A] general professional education should prepare medical students to learn throughout their professional lives rather than simply to master current information and techniques. Active, independent, self-directed learning requires among other qualities the ability to identify, formulate, and solve problems; to grasp and use basic concepts and principles; and to gather and assess data vigorously and critically (Muller, 1984).

Other endorsements calling for like changes in medical education followed in publications of The World Federation of Medical Education, The World Health Organization, and The Network of Community-Oriented Educational Institutions for Health Sciences (Berkson, 1992).

In addition to these prestigious bodies, schools initiated experimenting with PBL. Harvard Medical School began an experimental PBL track in 1985, called the "New Pathway," which quickly expanded to its entire class in 1987 (see Armstrong, 1991; Hafler, 1991; Moore, 1991; and Wilkerson & Hundert, 1991). Canada, considered at the forefront of medical education reform in post-World War II war years, has most of its sixteen faculties of medicine engaged in curriculum reform introducing PBL (Van Vluggen, 1993). While most of this emphasis is on medical education, educators in other disciplines are experimenting with PBL as well.

Boud and Feletti (1991) cite twenty institutions world-wide using PBL, nearly half of which are non-medical. Some of the institutions and subject areas include:

Mechanical Engineering, Imperial College of
Science and Technology, London (Cawley, 1991),

Social Work, University of New South Wales (Heycox
& Bolzan, 1991),

Optometry, Queensland University of Technology
(Lovie-Kitchin, 1991),

Architecture, University of Newcastle, New South Wales (Maitland, 1991),

Informatics, National University of Singapore (Morrison, 1991),

Law, University of Technology, Sydney (Winsor, 1991),

Industrial Engineering, Robert Gordon's Institute of Technology, Scotland (Usher, Simmonds, & Earl, 1991),

Management and Economics, Netherlands International Institute of Management (Foster & Gilbert, 1991), and

If we add to this the Problem-based Learning Assessment and Research Centre in Australia (PROBLARC, established in 1987) with 500 contacts in 25 countries representing 45 professional areas, the PROBLARC's bi-monthly newsletter (PROBE), the rapidly growing PBL INTERNET Email List (Hadgraft, 1993), and the bi-annual PBL conference, there appears to be plenty of pressure and incentive to consider the adoption of "The McMaster Philosophy."

In sum, the history of PBL reveals a grass-roots movement aimed at changing the curriculum because of a general dissatisfaction, and evidence attesting that traditional lecture and discussion is poor pedagogy. Barrows and Tamblyn's (1980) and Barrows (1985) work sets the stage for growth with their prescriptions on how to design and develop a PBL curriculum that provides a stimulating personal philosophy and rationale for change in medical education. Ironically, its impact on the scientific

community of medical educators has been unparalleled, despite the absence of "scientific" evidence on the relative merits of this new approach (Boud & Feletti, 1991).

Theoretical Underpinnings

The major theoretical foundation of PBL is derived, in part, from research in education and cognitive science (Albanese & Mitchell, 1993). Revealed through the PBL literature, the theories are based upon author,s suppositions and are revealed in a variety of ways. The theories are reviewed in an attempt to understand them as they relate to the form and function of PBL curriculum.

Koschmann, Myers, Feltovich, and Barrows (1993) outline a set of six principles they say "provide some guidance for what is necessary for promoting effective instruction" in any curriculum (p.8). These principles, taken together, comprise most of the instructional goals within the PBL curriculum design:

1. Principle of Multiplicity: Knowledge is complex, dynamic, context-sensitive, and interactively related; instruction should promote multiple perspectives, representations, and strategies;
2. Principle of Activeness: Learning is an active process, requiring mental construction on the part of the learner; instruction should foster cognitive initiative and effort after meaning;

3. Principle of Accommodation and Adaptation:

Learning is a process of accommodation and adaptation; instruction should stimulate ongoing appraisal, incorporation and/or modification of the learner's understanding;

4. Principle of Authenticity: Learning is

sensitive to perspective, goal and context; instruction should involve activities, settings, and objects of study that are authentic;

5. Principle of Articulation: Learning is

enhanced by articulation, abstraction, and commitment on the part of the learner; instruction should provide opportunities for learners to articulate their newly acquired knowledge; and

6. Principle of Termlessness: Learning of rich

material is termless; instruction should instill a sense of tentativeness with regard to knowing, a realization that understanding of complex material is never "completed", only enriched, and a life-long commitment to advancing one's knowledge.

Koschmann, et al., say PBL is a curriculum design that instantiates these six instructional principles.

The Albanese and Mitchell (1993) meta-analysis of the English-language international PBL literature from 1972 to 1992 highlights three authors' theoretical underpinnings for PBL. First is Schmidt (1983) who elaborates three principles: (a) prior knowledge (affects of past learning), (b) encoding specificity (transfer resulting from fidelity of resemblance between learning situation and application of knowledge), and (c) elaboration of knowledge (understanding and remembering enhanced by discussion, verbalization, question generating, peers review, and critiquing).

The second author is Barrows (1985), who points out that learning basic science in a problem-based format structures

information in memory in a way that aids subsequent clinical recall. This is similar, say the authors, to "Bruner's theory of discovery (inquiry) learning ... [which] suggests learning is enhanced when students actively participate in the process and when learning is organized around some problem" (Albanese & Mitchell, 1993, p. 54). It is also reminiscent of Schmit's second principle outlined above called encoding specificity.

Finally, Coles (1990) suggests that PBL closely resembles Contextual Learning Theory (CLT). CLT has three phases: context, information, and relating together (integrating). In PBL, the problem is the context in which relevant information is provided and then integrated back into the problem through elaboration.

Norman and Schmidt (1992) suggest the theoretical base of PBL emerges from cognitive psychology research on memory, problem solving, "case-based" reasoning, and from research on concept formation and categorization. They say PBL promotes three functions: (a) acquisition of knowledge in the context it will be used, (b) mastery of concepts to be applied to new problems, and (c) acquisition of prior examples. The next paragraph elaborates on each function.

Acquisition of knowledge in context emphasizes the importance of activating prior knowledge, elaboration (discussion, note-taking, answering questions, or using the

knowledge) at the time of learning, and matching the learning context to "real" situations the students will encounter. Mastery of concepts means that the problem must be approached in a problem-solving modality without much foreknowledge of the domain or underlying principle, and that the problem solver must receive corrective feedback about her solution immediately upon completion. Finally, acquisition of prior examples relates, the authors say, to an "instance theory ... that supposes for everyday classes of concepts, individuals have available in their memories many instances, and individuals make many categorical and diagnostic decisions on the basis of the similarity of a current instance to prior ones" (p. 562).

To review, Koschmann, et al.'s six principles (multiplicity, activeness, accommodation, adaptation, authenticity, articulation, and termlessness), Schmidt's three principles (prior knowledge, encoding specificity, and elaboration), Barrow's structured information, Cole's contextualized learning theory, and Norman and Schmidt's three functions (acquisition of knowledge in the context, mastery of concepts, and acquisition of prior examples) all provide a theoretical foundation for PBL. These theories are derived from research in education and cognitive science and concern the way humans learn. PBL supports these learning principles through the PBL curriculum by engaging

students in active, relevant, contextual learning. This in turn motivates and encourages independent and critical thinking, sensitivity to others, and development of habits leading to self-directed life-long learning (Barrows, 1985).

Goals and Objectives of PBL

Many authors have described the goals and objectives of PBL, which include:

Acquiring a retrievable usable knowledge base (Armstrong, 1991; and Barrows, 1985),

Acquiring professional clinical reasoning skills (Armstrong, 1991; Barrows, 1985; and Engel, 1991),

Acquiring self-directed learning skills (Barrows, 1985; Barrows & Tamblyn, 1980; Colditz, 1980; Drinan, 1991; Echt & Chan, 1977; and Woods, Yang, & Zhang, 1991),

Encouraging independent critical thinking skills (Barrows, 1985; and Drinan, 1991),

Encouraging sensitivity to all the patients' needs (medical & psychosocial) (Armstrong, 1991; Barrows, 1985; Des Marchais, J., Bureau, M., Dumais, B., & Pigeons, G., 1992; Engel, 1991; and Woods, et al., 1991),

Promoting faculty knowledge of students (Barrows, 1985),

Meeting individual student needs, styles, and backgrounds (Barrows & Mitchell, 1975),

Developing a concern for community problems (Des Marchais, et al., 1992),

Developing Creative thinking (Bihl-Hulme, 1985),

Approaching a medical problem scientifically (Colditz, 1980),

Acting as leader, collaborator, coordinator, and informant in a team (Colditz, 1980), and

Fostering Active Learning (Drinan, Archer, Brouwer, Moller, & Walsh, 1985).

These goals highlight the potential of the PBL curriculum and serve to guide the development of all aspects of PBL. Collectively, they form an objective base for the development of a medical professional and the design of the PBL curriculum. While not all-inclusive, these goals and objectives do reflect a distinct move away from amassing memorized knowledge toward a higher fidelity model that reflects life with all its uncertainties.

Benefits of PBL: Real and/or Perceived

PBL authors tout the benefits of this system with a biased vigor and little shame about the lack of research data available to substantiate it. Table 2 presents some supposed benefits found in the literature. These benefits relate directly back to the theory, goals, and objectives of PBL, promoting it as a promising alternative to LD. Drawing these out of the literature provides words and ideas that aid talking about and understanding PBL.

The benefits are a combination of explicit and implicit curriculum attributes that attempt to state what PBL offers. Surveying the list also gives an opportunity to think about

Table 2
"Short List" of PBL's Real and/or Perceived Benefits

<u>Benefit</u>	<u>Reference</u>
Activates prior knowledge	(Norman & Schmidt, 1992)
Allows interactions	(Lovie-Kitchin, 1991)
Applies new knowledge	(Ireland, 1985)
Assists elaboration	(Cawley, 1991)
Attracts higher quality student	(Des Marchais, et al., 1992)
Builds communication skills	(Boud & Feletti, 1991)
Builds human relations	(Boud & Feletti, 1991)
Builds "team work" skills	(Wallis & Mitchell, 1985)
Creates knowledge ownership	(Norman & Schmidt, 1992)
Develops meta-cognitive skills	(Barrows & Tamblyn, 1980)
Develops skill of inquiry	(Boud & Feletti, 1991)
Encourages cooperation	(Woods, 1985)
Forces organization of time	(Des Marchais, et al., 1992)
Forces reflection	(Boud, 1985)
Forces self-study skills	(Barrows & Mitchell, 1975)
Improves colleagueship	(Wilkerson & Hundert, 1991)
Increases motivation	(Norman & Schmidt, 1992)
Increases school visibility	(Fisher, 1991)
Instills active learning	(Ross, 1991)
Involves more emotions	(Bawden, 1985)
Maintains proactive learning	(Hurley & Dare, 1985)
Mimics natural learning	(Eisner, 1982)
Produces better grades	(Pales & Gual, 1992)
Promotes being humanistic	(Margetson, 1991)
Promotes critical thinking	(Morrison, 1991)
Promotes knowledge retention	(Norman & Schmidt, 1992)
Provides enjoyment	(Smith, 1985)
Requires subject integration	(Maitland, 1985)
Responds to change	(Boud & Feletti, 1991)
Supports nurturing	(Albanese & Mitchell, 1993)
Supports relevance	(Prosser, 1985)

what is not offered by the PBL curriculum. For example, there is no mention of the broader concept of developing a medical professional.

Theoretically, many of these claims could be attributed to any curriculum, but collectively they are inclined toward PBL. The benefits reported were found in the literature, but the list is not static. Highlighting them is just one way to describe the PBL curriculum. To understand other parameters of PBL, the next section outlines seven dominant PBL issues.

Major PBL Issues

Seven issues dominate the literature on PBL implementation and research: group process, self-directed learning, assessment, facilitator issues, curriculum structure, problem development, and resources. This section is a synopsis of each issue that highlights and illuminates their salient features. Though each issue is a domain in its own right, this review is restricted to their relationship within the PBL curriculum.

Group Process

Since tutorial group activity is necessarily intimate, highly interactional, and to a large extent student-initiated, its character is as varied and complex as the personalities and motivational levels of its member (Kaufman, 1985, p. 53).

The PBL literature contains many supposed benefits and drawbacks of the group process. Focusing on the group process provides an outline of a critical part of the PBL curriculum design. Small groups are the social sphere where many of the PBL goals and objectives are played out.

Early PBL framers chose small group learning as the supporting forum. Neufeld and Barrows (1974) describe the small-group tutorial as a learning laboratory of human interaction and identify benefits of using small-group tutorials which include:

- developing interpersonal skills,
- becoming aware of emotional reactions of self and others,
- learning how to listen,
- learning how to give and receive criticism,
- learning about educational planning,
- providing a forum for group problem-solving with pooled resources of the group members, in terms of academic training, experience, personality, and perspective,
- providing an opportunity for self-evaluation by which a student can compare informally his own learning progress with that of his peers,

developing a sense of responsibility for the learning progress of each member, and

learning how to give accurate and candid feedback to each other. (Neufeld and Barrows, 1974)

Other PBL literature repeats and adds to the list with small group benefits, goals, and aims, such as:

- allowing students to initiate and sustain discussion (Wilkerson, Hafler, & Liu, 1991),

- fostering development of problem-solving skills (Echt & Chan, 1977),

- training students in small-group leadership (Smith, 1985),

- motivating learning, heightening inquisitiveness, encouraging holistic learning, building self-confidence, improving communication and understanding of people (Drinan, et al., 1985),

- fostering elaboration of knowledge in a safe environment (Coles, 1991),

- allowing individual attention, helping build friendships, building accountability, pooling knowledge and backgrounds (Barrows, 1985),

- building "teamwork" skills and developing trust between individuals (Wallis & Mitchell, 1985), and

- providing an open, free, stimulating, cooperative, and realistic environment that is responsive to change (Barrows & Tamblyn 1980).

The composite picture of benefits of the group process indicates some of the supposed value and potential of this aspect of the PBL curriculum design.

Philp & Camp (1990) claim that the success of the PBL curriculum depends on good group dynamics, and that developing functional group interaction is critical to the

success of the process. Consequently, group process training is often mentioned in the literature (Colby, Almy, Zubkoff, 1986; Wallis & Mitchell 1985). But there is scant information on the nature of that group process training.

Barrows (1985) outlines beginning group activities consisting of introductions: establishing an open constructive working climate, responsibilities, and group objectives. But he says, "Most of these activities will not need to be repeated before each new problem" (p. 55). Considering all the claims in the PBL literature about group processes, there is a paucity of information concerning how it is to be done.

Another consideration within group process is a concern over individuals' being weaned away from the group in order to prepare for autonomous learning. Barrows (1985) suggests that, "At some point in the curriculum the group process should be abandoned in problem-based learning and the students allowed to continue in the problem-based learning process by individually anticipating their approach to clinical work" (p. 8). In addition, there is some evidence that students do become overly dependent on the small-group environment (Albanese & Mitchell, 1993).

Finally, the literature contains information on a few drawbacks of the group process: some students working harder than others (level of individual commitment), personality

differences, and insufficient direction causing insecurity for students and facilitators with each other and the curriculum (Abel, Margetson, & Sauer, 1985; and Lovie-Kitchin, 1991). Since the PBL process depends heavily on the small-group process, these drawbacks represent serious concerns. The literature review serves mostly to document the promise and problems of group process, but does not offer implementation or solution strategies..

Summary and Conclusion of Group Process Issue

Early PBL framers organized students into small groups as an integral part of the PBL curriculum design. Working in small groups has many alleged benefits and drawbacks. The literature serves to highlight these but falls short in offering suggestions to improve the group process.

Brilhart (1967), an author outside the PBL domain, says "Understanding the basic dynamics of small groups and the available theory about communication within them is essential if one is to be effective in the arts of small group interaction" (p. 18). Group processes, to a large extent, regulate the quality of the PBL learning experience. With that level of importance it is surprising that there is not more literature specifically about PBL group processes.

Self-Directed Learning (SDL)

No other term is used more often in the PBL literature than self-directed learning (SDL). It is, perhaps, the ultimate goal of PBL. Often coupled to the phrase "life-long," SDL involves inculcating in students the habit of evaluating their own abilities, identifying new skills and knowledge needed, and efficiently and effectively utilizing resources (Barrows & Tamblyn, 1980). SDL translates into shifting the responsibility for learning from the teacher/institution to the individual learner (Boud, 1985). The term for this shift of responsibility is largely known as student control (Wilkerson, Hafler, and Liu, 1991).

Other terms to describe approaches placing learners in control are democratic classrooms, discovery method, student-centered education, and self-regulated behavior (Gage & Berliner, 1988; Knowles, 1975; and Zimmerman & Schunk, 1984). The common denominator, learner control, can be seen as a continuum, with a learner's acquisition of knowledge and skills totally self-directed at one end and totally directed by others at the opposite end. Some of the promises of learner control are codified by Candy's (1991) writing, outlining its operational.

Candy (1991) notes, with six characteristics, that learner control: (a) responds to the inflexibility of conventional education, (b) recognizes the way adults

actually learn, (c) reflects the primacy of learning over teaching allowing for different learning styles, (d) leads to enhanced learning through increased motivation, (e) models democratic principles and behavior, and (f) inculcates habits of curiosity and self-initiated inquiry. These characteristics are useful for defining learning control and providing a way to describe it and talk about it.

In problem-based SDL, it is claimed that students learn how to learn, analyze their own thinking, ideas, logic, and analysis of data, and watch others do the same (cyclic reasoning process). This cycle of problem-solving, needs analysis, self-study, reapplication of knowledge, and critique of prior performance, develops students' "metacognitive" skills (Barrows, 1985). Then, study undertaken around group- and self-identified needs is more efficient; reading is done with more interest and retention, resources are found and used; and learning becomes focused and individualized (Neufeld & Barrows, 1974).

The goal in this curriculum is not an excessive store of facts, but rather the habit of continuing self-evaluation and self-education--the critical competencies of the future (Wallis & Mitchell, 1985). Problem-based SDL promotes the development of an organized approach to learning (define problem, explore solutions, plan, implement, evaluate) and

of thinking abilities such as creativeness, analysis, synthesis, generalization, simplification, and broadening of students' perspectives (Woods, 1985). These benefits are cultivated by PBL's emphasis of moving away from being taught and moving toward being self-directed.

As with the group process, the literature is charged with descriptions of how PBL aids SDL. PBL provides a focused environment that fosters students' SDL through individualization (Barrows, 1985), promotes utilization of resources (Neufeld & Barrows, 1974), facilitates elaboration, verbalization, personal goal and pace setting (Wilkerson, Hafler, & Liu, 1991), substantiates active and in context involvement (Boud & Feletti, 1991), fosters self-assessment (Engel, 1991), and avails more time for thinking (Barrows & Tamblyn, 1980). All of these constructs of SDL relate to the theories of learning upon which PBL is based.

However, while PBL facilitates the constructs of SDL, this is no guarantee that students will become expert self-directed learners. In fact, the literature reports mixed results of the effects of PBL on SDL. In addition, SDL is ill-defined, difficult to operationalize, and, therefore, difficult to measure. Marton et al., (1984) suggest that by observing how students study, it may be possible to infer the learning processes that are operating, which, in turn, determine the quality of what is learned.

Two conflicting studies attempt to quantify this relationship between study method and learning process. Both studies, using the same instrument (*Short Inventory of Approaches to Studying*, Entwistle, 1981) produce vastly different results. De Volder and De Grave (1989) investigated the aspects of a problem-based medical program on the study methods of 142 new students during the six week introductory stage of the program. Specifically, the researchers studied the affects of PBL on study methods in relation to varying student approaches. The approaches were described as (a) achievement orientation (study what's required for exam), (b) reproducing orientation (rote learning), and (c) meaning orientation (intrinsic motivation), the last being a primary goal of PBL.

According to the authors, meaning orientation can be achieved through either of two learning approaches: "operational learning", which entails a logical step-by-step approach and a cautious acceptance of generalizations only when based on sound evidence, and, "comprehension learning", which entails using analogies to relate ideas to real life and emphasizes broad outlines of ideas and their interconnections. The most effective learners use a combination of these strategies and are called "versatile learners." In contrast, an inappropriate reliance on one or the other has been termed "learning pathology" (De Volder &

De Grave, 1989).

De Volder and De Grave (1989) found no significant difference between the beginning and end of the introductory period with respect to achievement meaning orientation, operational learning, and learning pathology. There were, however, noted decreases in reproducing orientation and increases in meaning orientation, comprehension learning and versatile learning (De Volder & De Grave, 1989). The results, however, do not support the conclusion of a second, similar study using the same instrument.

Coles (1985) compared students at a conventional medical school with students at a problem-based school at the beginning and end of their first year. The results suggest PBL did make a difference, and the following comments were offered:

1. On entry, students at the two schools show similar approaches to studying.
2. At the time of entry, students' studying "profiles" seem enviable: low reproducing, high meaning, and high versatility.
3. At the end of year one, students at the conventional school show a significant shift toward poorer studying approaches: greater reproducing, lower meaning, and lower versatility.
4. This shift is not seen in students at the problem-based school, where entry approaches to studying are maintained.
5. Students at the problem-based school show less reproducing at the end of year one than on entry.

6. This shift seems desirable.
(Coles, 1985, p. 308)

Coles' study suggests that PBL provides an educational environment which fosters more desirable study habits. However, these different results are difficult to decipher.

Both studies contain little information concerning their methodology. In addition, self-report questionnaires are not a direct measure of the approach actually used. These reports, while attempting to operationalize and measure learning process through surveying study habits, make it difficult to say anything conclusively or comparatively. They do, however, serve to craft the language needed to discuss SDL.

Another attempt to quantify SDL was made by Patel, Groen, and Norman (1991) in a highly cited study examining the reasoning processes of beginning, intermediate, and senior students in two medical schools with conventional and PBL curriculum formats. They found that PBL students used more "backward-directed" hypothetico-deductive reasoning than conventional students, but about the same amount of "forward-directed" reasoning. They claimed PBL student's reasoning process does not match the "forward reasoning" of experts, resulting in a need for more attention to methods of correcting erroneous reasoning.

Wilkerson, Hafler, and Liu (1991) conducted a qualitative study of student-directed discussion in four

problem-based tutorial groups. Their research identifies five themes important in characterizing the extent to which students direct their own learning: (a) initiation of topics, (b) style and pattern of facilitator talk, (c) use of questions, (d) pattern of student-facilitator interaction, and (e) presence of pauses and interruptions. This study seems more significant in defining the elements most useful in building a model of SDL.

Finally, two observations prevalent in the literature relating to SDL warrant mention. First, students overwhelmingly report that they study harder but are more motivated in a PBL experience (Barrows & Mitchell, 1975; Cawley, 1991; Prosser, 1985; and Woods, 1985). Second, many authors allude to a need to provide more direction and structure early in the PBL experience, gradually allowing more self direction as learners progress (Barrows & Mitchell, 1975; MacDonald, 1991; Maitland, 1991; O'Brien, Matlock, and Loacker, & Wutzdorff, 1991). Of these two observations, the former provides justification for the implementation of PBL in relation to SDL, while the latter provides insights on how to develop SDL once PBL is implemented.

Summary and Conclusion of Self-Directed Learning Issue

In summary, self-directed life-long learning is a PBL goal promoted by emphasizing learner-control in a problem-based format. While the construct of SDL is difficult to define and measure, the studies mentioned shed light on ways researchers have tried, even though differing results were found when using the same instruments. One strong finding, however, is that while SDL within PBL is difficult for students, it is also enjoyable to them as they wrestle with problems and make them their own. It also seems clear this kind of learning should be introduced carefully and gradually in order to avoid frustration.

Assessment

Assessment comes into play in at least four different ways: (a) context evaluation, requiring an examination of the setting of the professional program, (b) input evaluation, demanding close examination of program plans and objectives, (c) process evaluation, looking at ways plans become reality, and (d) product evaluation, requiring a detailed examination of the outcomes (Fisher, 1991). This review focuses on product evaluation, since it falls in line with the research focus and because the bulk of literature on assessment refers specifically to product evaluation.

Conventional assessment is not compatible with the goals and objectives of PBL. As Norman (1990) claims, "[d]etailed behavioral objectives ... are the antithesis of problem-based, self-directed learning. If the view of assessment is restricted to the final examination, then it is assured learning will be directed to the final examination" (p. 254). Fisher (1991) points out that conventional assessment approaches do not include evaluation approaches that are "goal free, illuminating, ethnomethodological, qualitative, and responsive" (p. 285).

PBL students are to learn to manage their own learning, to assess themselves, and to relate to patients, peers and other professionals (Norman, 1990). Consequently, he says,

[I]f we wish our students to learn the skills and knowledge associated with community orientation, health promotion, population and public health, critical appraisal, lifelong learning, interdisciplinary learning or self-appraisal, then we are obliged to assess these objectives in a meaningful, reliable and valid fashion (p. 259).

To accomplish PBL assessment, there are a plethora of tools designed to extract the "rich data about each student available in the ongoing PBL process" (Barrows, 1985, p. 19).

Many of the PBL assessment tools presented in Table 3 are unfamiliar, hard to quantify objectively, and more labor intensive to use than traditional fare (Maitland, 1991). Similarly, PBL evaluation includes many abstract concepts

not easily operationalized for measurement. In PBL, no matter which tools are used, the final assessment is ultimately up to the facilitators' understanding and synthesis of an individual student's understanding and performance (Norman, 1990).

Table 3
PBL Assessment Tools

Client reports	Constant feedback
Consultant reports	Debates
Discussion	Essay exam
Face-to-face interviews	Final Exams
Log	Multiple Choice
Observation	Oral exam
Oral presentation	Peer-assessment
Peer jury assessment	Problem write-up
Records of books, articles, and software	Self-assessment
Simulations (written and/or live)	Think-out-loud exams
Tutor-assessment	Tutor jury assessment
Work completion or short answer	

Measures of self-directedness: problem-solving, motivation, effort, and attitudes

Barrows and Tamblyn (1980) identify three critical targets for PBL evaluation, consisting of: (a) clinical reasoning skills, (b) clinical (technical) skills, and (c) self-study skill. In addition they offer characteristics

and algorithms for evaluating the suggested tools (Table 4). Their recommendation is to orchestrate the tools based on objectives and on what can and cannot be accomplished with the tools selected for use.

Table 4
PBL Evaluation Tools and Techniques

Characteristics of Evaluation Techniques and Tools

- * Process versus Content (what is evaluated)
- * Process versus Outcome (what is evaluated)
- * Reliability (two examiners, one score = reliability)
- * Validity (content adequately samples area measured)
- * Fidelity (extent to which test resembles real life)
- * Feasibility (ease of administering, scoring and analyzing)

How to Evaluate Tools

Reliable with questionable validity

- * Multiple Choice/True-False Questions (info recall only)
- * Work-completion or Short-Answer Questions

Poor reliability with questionable validity

- * Oral Examination
- * Essay Examination

Valid with questionable reliability

- * Observation of a Patient Interview and Examination
- * Review of Case Record, and record audit

Note. From Problem-based Learning: An Approach to Medical Education (p. 113-131) by H. Barrows and R. Tamblyn, 1980, New York: Springer Publishing Co.

Because of the shift away from pure factual knowledge and toward problem solving skills and self-directed learning, most PBL courses use a pass/fail grading system. Barrows and Tamblyn (1980) assert that educational assessment tools should be designed to help students develop their own

approaches to self-evaluation which can be continued throughout their lives. PBL evaluation should be a constructive and helpful process, leading to improved learning and performance and to increased openness for helping self and others (Barrows & Tamblyn, 1980).

Summary and Conclusion of Assessment Issue

It is clear from the literature that assessment has an important role in helping students develop their learning skills. Traditional assessment for measuring stored knowledge against pre-set objectives does not promote the PBL objective of creating a life-long learner who constantly performs ongoing self-appraisals. Many assessment tools are available for PBL, but each requires an understanding of the tool and of the knowledge and/or skill it measures. The literature review helps make clear the role of assessment in the PBL curriculum.

Facilitators

The term facilitator and tutor are used interchangeably in the literature. They refer to the overseer responsible for a group session. For the purposes of this review the term "facilitator" is used understanding that, in the literature the two terms are operationally synonymous.

The literature reveals a myriad of roles attributable to the facilitator (Table 5). In addition to facilitator roles, there are five prevalent issues in the literature: (a) expert versus non-expert facilitators, (b) facilitators training, (c) roles changes from teacher to facilitator, (d) relationship changes between students and peers, and (e) changes in time commitments for teacher turned facilitator. This section explicates those issues.

Table 5
The Multiple Roles of a Facilitator Within PBL
Context

Advisor	Advocate	Administrator
Assessor	Career counsel	Caring
Challenger	Content consultants	Group leader
Instigator	Learner	Listener
Moderator	Monitor	Problem writer
Resource manager	Resource person	Role model
Sounding board	Stimulator	Supporter
Unit planner		

Discussing "expertness" is problematic because of the varying degrees of expertise. But for this discussion facilitators will be considered either experts or not experts. Facilitator expertise is a combination of content expertise and group leadership expertise. Content expertise is further divided into subject knowledge and knowledge of the case at hand.

Barrows (1988) asserts that the ideal situation is to have a content expert who is familiar with the case and who is also an expert facilitator. Lacking that, the next best arrangement is to have an expert facilitator who is very familiar with the problem. This hierarchy continues down until there is a content non-expert and facilitator non-expert with a new case, which constitutes the poorest arrangement possible.

Being a "subject knowledge" expert in PBL is limited because of the multidisciplinary problem focus of the curriculum. However, being an expert on the case at hand is a function of experience with that case. It has been suggested that a facilitator can be considered an expert on a particular case after three uses of the same case (Zeitz & Paul, 1993).

There is a good deal of research on the topic of facilitator expertise, and the literature overwhelmingly supports the use of facilitators with expertise in content, tutoring, and the case in progress (Barrows, 1985; Davis, Nairn, Paine, Anderson, & Oh, 1992; Eagle, Harasym, & Mandin, 1992; Johansen, Martenson, & Bircher, 1992; Mattern, 1992;). Tolerance for using facilitators without expertise is found in the literature. Discussing these helps put facilitator expertise in perspective and provides other ways to think about it.

For very immature learners there is evidence that first-year students are generally more satisfied with non-expert facilitators (non-expert faculty or advanced students) than are second-year or third-year students. It is clear, however, that as the students' sophistication rises so does their need/desire for a more expert facilitator (Johansen, et al., 1992). This does not mean that expert facilitators are still the most desirable. It means only that they can be tolerated by novice students.

In relation to teaching staff opinions, Feletti, Doyle, Petrovic, & Sanson-Fisher (1982) conducted a self-report survey on teaching staff opinions and found that the teaching staff felt that non-content expert facilitators are as effective as those with up-to-date information. This sentiment was not shared by the students, who consistently rated content expert facilitators superior to non-experts. This is an interesting window on facilitators' assessment of their own utility.

One consistent finding, however, is that groups with content expert facilitators, who had facilitator training or experience, were significantly more satisfied with their experience. These groups scored significantly higher on test questions and generated two to three times the learning issues while spending about twice as much time on the problem as those students with a non-expert facilitator

(Davis, et al., 1992; Eagle, et al., 1992, and Mattern, 1992). The hypothesis offered for this occurrence is that these expert facilitators were able to provide support, cues, or guidance when needed.

In addition, expert facilitators asked questions at a more appropriate time, and the questions asked communicated more to the students. Almost certainly, an expert can form questions that could be of more value to the student (Davis, et al., 1992). This hypothesis agrees with Eagle, et al., (1992) who found that a competent facilitator will stop at critical points to clarify, elaborate, allow silence, ask for justification, summarize, probe, and challenge, thus enhancing student-directed learning, listening, focusing, and contemplation.

Turning to a different facilitator issue, several authors mention that facilitator training is either needed or provided. Recommendations range from having formal, professional workshops to simple PBL observation and participation (Davis, et al., 1992; Feletti, et al., 1982; Ryan & Little, 1991; Todd, 1991; Wallis & Mitchell, 1985; and Wilkerson & Hundert, 1991). A frequent comment concerns the difficult time facilitators have changing roles from teacher to facilitator (Des Marchais, et al., 1992; Engel, 1991; Macadam, 1985; Todd, 1991; and Wilkerson & Hundert, 1991). This is significant because of how facilitators,

expert or not, affect the dynamics of the small-group PBL process.

By virtue of their familiarity with the content, expert facilitators have the potential to pose questions at critical moments, and in this, way have a powerful potential to influence learning. These questions are important because they can enhance the identification of learning issues, and therefore, the achievement of PBL course goals. Whether this expert direction detracts from the pure goal of student-centered, self-directed learning is an issue of concern (Mattern, 1992).

Specifically, Silver and Wilkerson (1991) found that when small groups were led by subject matter experts, the experts talked more, longer, and made more suggestions. They conclude that students are less likely to produce student-directed discussion and collaborative learning. Albanese and Mitchel (1993) conclude that the use of expert facilitators results in gains in learning efficiency, knowledge, and satisfaction at the expense of student-initiated learning.

Another facilitator issue is facilitator time commitments. Whenever reference was made to faculty time commitments required of a facilitator, the estimate was always 10-20% higher for PBL than for traditional curriculum (Neufeld & Barrows, 1974; and Pales & Gual, 1992). While

this was accompanied by a higher level of satisfaction (Fisher, 1991; Pales & Gual, 1992), faculty time--real and perceived--remains a key limiting factor (Foster & Gilbert, 1991).

The final facilitator issue deals with the overwhelming changes in relationships when converting from LD to PBL. Wilkerson and Hundert (1991), in a report of the unprecedented, full-scale implementation of PBL at Harvard Medical School in 1987, discuss the need to involve teachers who had never thought much about learning nor worried about facilitating student interactions. The change from teacher to facilitator requires a redefinition of relationships concerning:

teachers' and students' learning--no longer disseminators, trusting students, guiding through questioning, and feedback;

teachers and content--cover everything verses let them choose what they need, realize a rich network of connections among ideas facilitates understanding and remembering;

teacher and student--partner with students in learning, loosen control of content and process of learning, students learn to ask questions and provide extended explanations;

student to student--when working with problem material, students become actively engaged with one another, characterized by cooperation rather than competition;

teacher to group--attentive to the needs of...group and the health of the group...fostering a cooperative spirit;

teacher and self--self-awareness through thought-provoking questions and managing participation, reflective; and

teacher and other teachers--collaboration, vulnerability, modelling of the process of self-directed learning.

Commenting on the process Wilkerson, and Hundert (1991) note that, "a facilitator's own self awareness and psychological sensitivity cannot be emphasized enough as ingredients in the mix that makes for a good learning environment--and so also as a central issue in faculty development" (p. 171).

Summary and Conclusion of Facilitator Issues

In summary, facilitators are vital to PBL and have many roles to fulfill. Their expertise, growth, training, changes in relationships, and time commitments are all major constructs concerning their role as a facilitator. The PBL literature concerning facilitators is largely focused on whether facilitators should be experts and is often unclear about what is meant by the term expert. While there are many roles outlined in the literature for facilitators, there is little guidance on how to perform them.

Curriculum Structure

The literature is replete with PBL design models, each with unique features, but all following the generic Barrows and Tamblyn (1980) model. Their model encompasses all of the critical elements of PBL. While every design is unique to its authors, the similar features provide a common group for determining the critical aspects of the curriculum.

All the models outlined in the literature center around a case or problem and usually include learning objectives, issues for discussion, suggested teaching strategies, related resources, study materials, bibliography, timetable, and rules. These materials are frequently arranged in handbook form (Colby, Almy, & Zubkoff, 1986), problem boxes (Barrows & Mitchell, 1975), course books (Pales & Gual, 1992), videos (Smith, 1985), situation improvement packages (Ryan & Little, 1991) or discipline maps (Engel, 1991). All are designed for the same purpose: to provide a learning environment where students have responsibility for their own learning.

Feletti and Wallis (1985) discuss the development of a PBL curriculum in a way that resembles a traditional instructional system design. Their prescription for developing a curriculum is to evaluate the environment, define the problem, explore options, develop a plan, implement a plan, and evaluate the outcomes. Like any

curriculum, the authors report that PBL development is labor-intensive (Feletti & Wallis, 1985) and requires many trade-off decisions (Abel, Margetson, & Sauer, 1985). The literature does provide some strategies for developing the curriculum.

A key strategy is the idea of reiteration of subject matter with increasingly more difficult problems. Increasing the problem difficulty creates a matrix where the 'vertical' development of specialized subject areas is woven through the 'horizontal' progression of problems. In this design, the general pattern of problem-solving, and the interdependence of social, technical, cultural, and managerial factors within it, are emphasized (Maitland, 1985).

Another strategy is applied by Woods (1985), who introduces workshops to help students deal with the radically different nature of learning in PBL. The workshops are used to increase students' confidence and skill in group process, problem solving, and self-assessment, and to train students in stress management and ways of coping with the disequilibrium they will experience when such a different approach is taken. Adding these workshops to the curriculum structure smooths the transition from traditional LD to PBL.

In another approach, Bihl-Hulme (1985) introduces creative thinking into his PBL curriculum. He introduces the use of mind maps as a way to help students develop the skills of divergent and creative thinking. These thinking skills include fostering students' ability to generate ideas and consider possibilities, and easing cognitive dissonance when listing options, pursuing the maybes, and wandering off on a theoretical tangent.

Summary and Conclusion of Curriculum Structure Issue

In review, curriculum structure in PBL is designed to present students with a problem they have not previously studied. These problems are presented through high fidelity scenarios allowing students to identify their own knowledge deficiencies. The curriculum structure is modelled after the foundational work of the "McMaster Philosophy" and Barrows' (1985) and Barrows and Tamblyn's (1980) seminal works on PBL curriculum design. The literature provides sufficient examples and perturbations to make clear the general design, but also to highlight that the design of one program may be incompatible with another.

Problem Development

If PBL is the road to learning, and small-group tutorial is the vehicle of choice, problems fuel the vehicle on the road. According to Barrows (1985), problems should be structured to allow a learner to do whatever would be possible in the real situation. He says,

They [students] must be able to ask the patient any question, perform any item of physical examination, or order any laboratory test in any sequence as they attempt to determine the basic mechanisms responsible for the patient's problems.
(p. 16)

The problem may be described as statements, questions, or descriptions (Abel, Margetson, & Sauer, 1985). Problems can be presented to students in paper form, verbally, through reasoning or calculation, by 'signposts', in groups, individually, or laid out in some other medium, such as computer or drama. Students say that the clear, consistent relevance to professional work is what they value most (Prosser, 1985).

Relevance is the most critical aspect of a problem. A problem's relevance can be measured by its fidelity, meaning the degree to which it emulates real life situations (Coles, 1991; Drinan, et al., 1985; Hafler, 1991; Prosser, 1985; and Smith, 1985). Fidelity relates directly to the theory of contextualized learning, which holds that learning is best served when done in the context it will be used.

Other principles for problem development and selection have been offered by Prideaux and Farmer (1994) who outline six development principles: (a) relevant problems, (b) multifaceted problems, (c) integrated problems, (d) consistent problems, (e) clinically current problems, and (f) motivating problems. In explanation they say,

[t]he principle of relevant problems illustrates the importance of considering incidence and significance of medical conditions. Principle two addressed the need for diversity of learning opportunities, while three and four emphasized the relationship of cases to aims, content, and sequence of the PBL curriculum. Motivating problems has to do with open endedness and student interest (pp. 131-133).

Prideaux and Farmer's (1994) principles highlight some considerations that can be used for problem development.

Real life is told in stories, and so PBL problems are actually developed stories (Armstrong, 1991; and Hafler, 1991) structured for a specific form of delivery (Foster & Gilbert, 1991). The stories come from personal experience (Hafler, 1991), surveys (MacDonald, 1991), or expert ideas about what is important for learners to know (Dolmans, Gijsselaers, Schmidt, & van der Meer, 1993). Most case writers are experts in the field comprising the main topic of the story and find story writing an enjoyable and creative aspect of their work. The broad goals of PBL allow case writers to "tell the story" as they know it (Hafler, 1991).

To write cases, field experts are joined by design groups consisting of medical practitioners, and a curriculum coordinator who provides educational expertise (Armstrong, 1991). The case writing process constitutes the following steps: development and planning, writing the case, case review, case use, and evaluation of the case after use (Hafler, 1991). A popular case method in the medical field is revealed through a set of progressively distributed pages or sections of a problem (Armstrong, 1991).

Problems are designed with the idea that they will generate learning issues related to a particular medical topic. One way to determine the effectiveness of a problem is the degree of correspondence between the learning issues generated and the problems suggested learning issues. Ineffective problems cause difficulties for students in generating the appropriate learning issues (Colditz, 1980).

Several studies use this "correspondence" approach to determine problem effectiveness. The average measure of correspondence for what are considered good problems is 60%. Evaluation of problems using this "match" between the problems' learning issues and the students' learning issues allows identification of problems not meeting their designed purpose (Albanese & Mitchell, 1993). Ensuring content coverage, by introducing pertinent problems, requires faculty to select appropriate numbers and types of problems

that will encompass pertinent content areas.

Dolmans et al. (1993) developed one way to check this correspondence by using experts' judgments to measure the agreement between the two. He labels mismatches as Type A or Type B (Table 6). This procedure attempts to illuminate the incongruence between the learning issues that the case writers wanted illicit, and the issues that the students generated. Using this system as formative evaluation allows for constant revision and refinement of existing cases, or ideas for new cases within the program.

Table 6
Learning Issue Correspondence Evaluation

Type A mismatches

Definition:

Faculty objective not
 identified by students

Attributes of Mismatch:

1. Those related not so much
 to problems as to other
 curriculum activities
2. Those spanning more than
 one problem
3. Psychological and social
 objectives

Type B mismatches

Definition:

Issues generated beyond
 faculty objectives

Attributes of Mismatch:

1. Those related to prior
 knowledge deficiencies
 (revealing)
 2. Those focusing on patient
 management and medical
 intervention rather than on
 physiology or pathophysiology
 (wrong focus, diagnosis and
 treatment rather than
 underlying pathology)
 3. Those associated by
 faculty with additional
 curriculum activities (skills
 & procedures learned
 elsewhere)
 4. Those arising from
 students personal interest in,
 and experiences with, the
 subject matter (popular
 subjects)
-

Summary and Conclusion of Problem Development Issue

Problems provide the focus for PBL programs and come in many forms (paper, actors, computer, mock ups, drama). Whatever the form, problem's serve to provide students with information that leads to identification of self-identified learning needs. According to the literature, it is critical that problems have high fidelity and allow students to proceed in a way that is contextually the same as encountering the problem in actual practice. The learning issues generated by students working on a problem can be used to evaluate the problems effectiveness. The literature outlines the design of PBL problems, their role in the classroom, and ways of evaluating problems.

Resources

One goal of PBL is to help learners identify and utilize resources (Barrows, 1985). There is evidence, based on faculty members' observations and recent studies (Rankin, 1993; and Saunders, Northup, & Mennin, 1985), that greater proportions of PBL students use the library more frequently and for longer periods of time than do students in conventional schools. According to Philp & Camp (1990) students in a PBL curriculum at the Bowman Gray School of Medicine use library resources five to ten times more than

the LD students.

High resource use impacts the library's collection, instructional program, facility, staffing, and budget (Rankin, 1993). It also impacts the resources available for support of lectures and non-PBL students. If a school were to make a wholesale switch to PBL, as Harvard's New Pathway did in 1987, severely limited resources may impact the school and students in a critical way.

A standard problem design format lists, at least partially, the learning references and resources associated with the problem or program (Armstrong, 1991; Colby, Almy & Zubkoff, 1986; Curry, 1991c; and Echt & Chan, 1977). Many authors, such as Woods (1985), create their own resources from lecture material of the original course, or by gathering or creating learning resources through printed materials, audiovisual formats, models, and specimens. Often other resources are created for facilitators in the form of guides and forms.

Finally, computer resources play an ever increasing role in the PBL curriculum, from problem simulation to information retrieval. Koschmann, et al., (1993) developed a rationale and method to introduce computer support for collaborative learning (CSCL) into the PBL program. They hypothesized that CSCL could serve as the blackboard, case data-base, group dynamic organizer, communication port for

human and non-human resource, and case builder structural organizer. Currently, however, the literature is void of models that make use of such a system.

Summary and Conclusion of Resource Issue

To recap, one of PBL's goals is to develop future practitioners who can identify, find, and use resources. These are the competencies of the future, when the information age changes the way we work and play (Zach, 1990). Evidence suggests that PBL students use resources more than LD students. The impact on the curriculum and students is meaningful in terms of resource availability and use. The literature provides a focus on resource considerations based on institutional experiences that are valuable to the overall PBL curriculum design.

PBL Meta-analyses

This section summarizes three meta-analyses of PBL evaluative research. First is an analysis of twenty years of research on PBLs effectiveness. Second is a PBL literature review covering twenty-two years which: "1) summarize[s] all available data that compare PBL with more traditional methods of education and 2) analyze[s] variations in these data by common meta-analytic techniques,

[and] 3) review[s] the perceived strengths and weaknesses for research in this field" (Vernon and Blake, 1993, p. 550). The third review covers the literature published before 1992 and concentrates on the effectiveness of PBL.

In a meta-analysis of sixty-six PBL studies in the English-language international literature from 1972 to 1992, Albanese and Mitchell (1993) reported on the comparison between PBL and LD on twelve factors thought to be important indicators of a good medical education. These factors, the number of studies considered, and a brief summary of their analysis include:

1. Basic science examination performance: (10 studies), LD generally higher than PBL (6 of 10), only three at a .05 level of significance;
2. Clinical science examination performance: (7 studies), PBL generally better than LD (5 of 7), only one significantly;
3. Thought processes promoted: (3 studies), PBL taught and use backward reasoning thus seemingly calling for more attention to correcting erroneous reasoning;
4. Study behaviors promoted: (6 studies), PBL students study for understanding or to analyze what they need know and have more library use;
5. Learning environment promoted: (4 studies), Kellner Symptom Questionnaire showed PBL students substantially less stressed. PBLers generally rated their experience higher in terms of meaningfulness, flexibility, emotional climate, nurturance, and student interactions;
6. Student's satisfaction, selection, and retention: (10 studies), PBL found to be engaging, difficult, useful, and enjoyable; LD found irrelevant, passive, and boring. 4%-20% of PBL

students will not thrive; and

7. Graduates' perceptions of their preparation: (6 studies), PBL graduates view the quality of their training more positively than LD in humanistic areas, clinical reasoning, preventive care.

8. First choice of residency: (2 studies), 79% PBL vs 59% LD in one, and 90% PBL vs 71% LD another.

9. Clinical ratings of graduates & undergraduates: (7 studies), Clear trend toward higher ratings for PBL by supervisors.

10. Performance assessments of graduates: (3 studies), Generally good for PBL but worries of incomplete cognitive framework would likely cause more referral to specialists, resulting in more cost per patient.

11. Specialty choices and practice characteristics: (8 studies), General trend for PBL students toward family practice, but some concern about the likelihood of a solo practice because of group experience.

12. Faculty members' satisfaction: (8 studies), Faculty find PBL a satisfying way to teach. (They like the personal contact/small groups).

The authors conclude that more research is needed before a complete and unqualified endorsement of PBL can be made.

They state:

While weaknesses in the criteria used to assess the outcomes of PBL and general weaknesses in study design limit the confidence one can give conclusions drawn from the literature, the authors recommend that caution be exercised in making comprehensive, curriculum-wide conversions to PBL until more is learned about (1) the extent to which faculty should direct students throughout medical training, (2) PBL methods that are less costly, (3) cognitive-processing weaknesses shown by PBL students, and (4) the apparent high resource utilization by PBL graduates (p. 1).

The literature contains no evidence that any schools are doing the type of PBL research identified by Albanese and Mitchell, nor that differences in PBL approaches make generalization difficult from one PBL program to another.

In another meta-analysis, Vernon and Blake (1993) reviewed the evaluative research from 1970 through 1992 on 35 studies over 19 institutions. Using effect-size and supplementary vote-count, they performed five separate meta-analyses:

1. Students' Program Evaluation: (12 studies), PBL superior without exception on attitudes, opinion of faculty, class attendance, mood, and stress;
2. Academic Achievement: (8 studies using the National Board of Medical Examiners Part I), Effect size favors traditional, vote count showed no difference, and, (7 studies on factual knowledge tests other than NBME I), Trend favored traditional but not statistically significant;
3. Learning Process: (2 studies on learning approach), Both suggest PBL students use more "meaning" than "reproducing" and LD more "reproducing" and less "meaning," and, (4 studies on learning resources used), PBLers use a greater degree of independent study than traditional students;
4. Clinical Functioning: (12 studies comparing PBL to traditional), PBL significantly better statistically on clinical performance; and
5. Clinical knowledge: (4 studies), Slight but nonsignificant trend favoring PBL.

The authors conclude that their results generally support the superiority of the PBL, but they are less than fully conclusive:

The present meta-analysis of evaluative research indicates that it is unlikely that students will suffer detrimental consequences from exposure to PBL programs. . . .The analysis highlights the need for methodologically rigorous studies that further address the value and effects of PBL" (p. 561).

Finally, Berkson (1992) conducted a meta-analysis of the literature published before September 1992 on the effectiveness of PBL. This analysis purports to establish whether or not PBL is fulfilling its promises, outlined in a series of seven questions:

1. Do PBL curricula teach problem-solving better than traditional curricula? To date there is no such evidence.
2. Do PBL curricula impart knowledge better than traditional curricula? Superiority of PBL over traditional curricula cannot be assumed without a better understanding of how type, number and sequence of problems affect learning.
3. Do PBL curricula enhance motivation to learn medical science better than traditional curricula? Motivation is hard to measure and PBL is not unique in its capacity to stimulate curiosity nor is it immune to factors that inhibit interest. No one has yet convincingly measured and compared the interest of a PBL student with that of a traditional student.
4. Do PBL curricula promote self-directed learning skills better than traditional curricula? Post-graduate practice of SDL strategies may prove more dependent on the proximity of available resources, peer expectations, role models, the physician's practice profile, and time constraints than "putative" skill previously acquired or refined in a PBL or traditional curriculum.
5. Why does the product of a PBL curriculum seem indistinguishable from traditional curriculum? PBL and LD products look the same at the end of the program because of curriculum commonalties; students, texts, clinicals, licence exams, and

faculty all homogenize the outcomes.

6. Does a PBL promote more student and faculty satisfaction than a traditional LD? Not a panacea. Students have conflict with ambiguity of learning objectives and the need to prepare for licensing exams. Faculty complain about suppressing their expertise and competing academic expectations and time commitments.

7. Does a PBL cost more than LD? Hard to determine but could be daunting for schools with a large number of students or small schools on a tight budget.

Berkson concludes that the PBL graduate is not distinguishable from a traditional graduate, and PBL has not fulfilled its expectations; but those expectations were probably unrealistic to begin with. She proclaims that preoccupation with principles of learning and pedagogy is a PBL strength and that its central weaknesses probably lie in its non-expert facilitator and cost. While the two curriculum approaches seem dichotomous, in the years to come she thinks environmental and accreditation pressures will likely force both curriculum designs to become more alike (Berkson, 1992).

Summary and Conclusion of Meta-Analyses Review

Meta-analysis is a tool employed to aggregate results from many studies to add power and generalizability to discrete and disparate findings in a field. In all, these three meta-analyses provide an array of results based upon an attempt to "let the research speak." Each analysis draws

from essentially the same literature base and the message is mixed.

The aggregate message after 22 years of research is not conclusive. Inconclusive results suggest there may be a problem with the way PBL is being studied. Two factors concerning the PBL literature are (a) the research being done by PBL practitioners who necessarily have bias tendencies, and (b) strictly quantitative research being used which decomposes and decontextualizes the curriculum and does not consider the robust relationships within the PBL curriculum design. Wolf (1993) summarizes the first two PBL meta-analyses by stating:

The implications and recommendations that I believe the results of Vernon and Blake's and Albanese Mitchell's reviews most strongly support are that (1) there is a paucity of good-quality studies and evidence available regarding the hypothesis that PBL produces learning and/or learners different from or superior to those derived from traditional approaches, (2) results often are incomplete and poorly reported in the existing primary research reports, (this needs to improve), and (3) there is tremendous need for well-designed, creative primary research-evaluation studies that examine important, clinically relevant behaviors and out comes" (p.544).

In Wolf's conclusion, and in the conclusions for each of the meta-analysis studies, one strong and consistent theme appears, the call for good research. Perhaps the call should be for different research.

Summary and Conclusion of Literature Review

A review of the PBL literature serves to define PBL, review its historical roots, and reveal seven prominent issues: group process, self-directed learning, assessment, facilitators, course structure, problem development, and resources. In addition, three PBL meta-analyses are reviewed. These issues and reviews help shape the research design and point in an informed way to what is important and needed in PBL research.

PBL literature is primarily quantitative, which assumes an objective reality existing and waiting to be found. Qualitative research assumes that reality is socially constructed in the context of lived experience, and therefore, must be studied through observation and participation. One conclusion from the literature review is that qualitative research is needed in PBL for informing the domain in a different way than has been attempted.

This literature review was completed prior to field work, based on the recommendation of Glesne and Peshkin (1992), and the need for a problem focus. Problem-based learning has proven to be sufficiently ill-defined and immature as a curriculum design to warrant further study. The next chapter describes the methods for this study.

CHAPTER III

METHODOLOGY

Introduction

This chapter presents the study methodology. It is organized into nine sections: type of study, rationale for design, access to site, human subject review board, pilot study, sample selection, data collection techniques, data analysis procedures, and summary. These sections are presented in the order they occurred and provide a detailed portrait of the study.

The first two sections are based on the theoretical tenets of the qualitative research paradigm; the next six sections are "stories" about how the theoretical tenets were applied. Last is a summary discussion and some notes on anomalies experienced during the study. The type of study is presented first.

Type of Study

This study is based on the widely recognized doctrine of naturalistic inquiry (Bogdan & Biklen, 1992; Eisner, 1991; Geertz, 1973; Glaser & Strauss, 1967; Glesne & Peshkin, 1992; Guba, 1981; McCutcheon, 1994; and Patton, 1990). Specifically, it is an observational case study (Bogdan &

Biklen, p. 63) using inductive reasoning. An observational case study is characterized by data-gathering techniques including participant observation, interview, journal writing, document analysis, and video tape review.

Qualitative research questions are not framed by operationalizing variables. Instead, questions are formulated to investigate topics in all their complexity in context (Bogden & Biklen, 1992). These complexities are often described as qualities which, when made explicit, allow them to be known at least partially by those who are not there (Eisner, 1991). Therefore, the research task is to understand and interpret how participants in the setting construct the world around them (Glesne & Peshkin, 1992).

It is useful to summarize Eisner's (1991) six features of qualitative study: (1) qualitative research is field focused and usually non-manipulative; (2) this kind of research uses the self as an instrument and values personal insight as one source of meaning; (3) is the interpretive character of qualitative study as it attempts to explain why something is taking place; (4) qualitative research uses expressive language and the presence of voice in text to help readers experience the phenomenon being observed; (5) it features attention to particulars designed to avoid reduction of data but allows for the full flavor of a particular situation, individual, event, or object to be

revealed; and (6) its success is judged through coherence, consensus, and instrumental utility (p. 32-40). A brief review of these three judging characteristics is next.

According to Eisner (1991) there are three tests of success for qualitative research: coherence, consensus, and instrumental utility. Coherence refers to credence or credibility, whether the report "rings true"; consensus is the concurrence that the findings are consistent with the evidence supporting them; and instrumental utility refers to the usefulness of the study in the sense of comprehension and the ability to anticipate future similar events in relation to prediction, maps, and guides. These tests and the other five features highlight the critical aspects of a qualitative study (p. 32-40).

Rationale for Design

A qualitative research design was chosen based upon the research needs outlined through the literature review. A review of research documents reveals only 1 of the 22 studies as qualitative. In fact, 3 of those 22 studies are meta-analyses without inclusion of any qualitative research whatsoever. The implication is that there is a bonafide need for qualitative research PBL.

In addition, Graham Feletti (1993), in his keynote address to the Australian Problem Based Learning Network during their 1993 conference on PBL, notes:

What areas of research still need attention?
There is one other basic need for research on problem based education--namely that good quality research be done and reported from the classroom or field, by the tutors themselves. We need good *qualitative* [italics added] studies, like those done by Lu Ann Wilkerson on PBL tutors and Janet Hafler on PBL case writing. We need broader description and analysis of what works and what doesn't in the PBL teaching and learning process. Quantitative research is fine, but researchers can miss valuable information by mainly focusing on measured perceptions or outcomes rather than learning process (pp. 4-5).

This acknowledgement is also in the conclusion of a review of literature on PBL outcomes and implementation. Albanese and Mitchell (1993) "suggest that future research should attempt to document more concretely the types of PBL approaches being used in the various curricula." These examples help justify the selection and need for qualitative research.

Qualitative research is an attempt to know our world by studying it "as it is" with all its complexities and context. Qualitative research is accomplished through observation of existing intact settings and it is used to identify the "qualities" that make up what members of that setting define as their reality. Commonly known as the interpretivist paradigm, this way of knowing assumes that

reality is socially constructed, complex, interwoven, and subjective.

Finally, qualitative research makes sense because it lends itself to the phenomenon being investigated (Guba, 1981, p. 76). The superabundance of claims for PBL makes qualitative research, with its inductive reasoning, a good tool to build a basic understanding of the salient aspects of this innovative curriculum design. A small literature base, resistance to decontextualization, and the absence and call for qualitative research justify the selection of a qualitative design study methodology.

Access to Site

Bogdan and Biklen (1992) state that "[t]he first problem to face in field work is getting permission to conduct your study" (p. 80). Getting access turned out to be one of the easiest things about the whole project. Initial interest, early meetings, and a luncheon seminar paved the way for access.

Initial interest in PBL came through a conversation with my primary advisor about problems with my original research agenda. He knew of my interest in curriculum design from previous work we had done together and suggested the possibility of research on the experimental "Problem-Based Learning Pathway" (PBLP) in the College of Medicine. That

same week I serendipitously noticed a bulletin advertising a luncheon seminar on the PBLP being presented by the program director.

At the seminar the director explained the philosophy and process of the program. He had brought several PBL students with him to field questions at the end of the session and it ended with a lively discussion between the students and attendees. Following the seminar, I introduced myself to the director and arranged to meet with him privately the next week to discuss research possibilities. That meeting set the stage for full access to the research site.

Our first meeting was used to explain my background and interest in the program and share how I had come to learn about it through my advisor and the seminar. The director was enthusiastic, positive, open, and eager for any research on the program. He said that since he started the program he had not found time to "write it up" or do any research because of his extensive duties as director. Consequently, he gave a *carte blanche* invitation for any type of research.

To reinforce and extend his open door offer, he provided me with all the PBLP program brochures, a copy of Barrows and Tamblyn's (1980) seminal book on PBL, and even offered to assign me as a group facilitator for one of the PBLP groups. The facilitator offer was declined, however, because it would have interfered with data collection. The

time from the initial advisor conversation to full site access was three weeks.

Two key elements were crucial to the success of the study: the PBLP secretary, and electronic mail. The most helpful thing for access was developing a good working relationship with the PBLP secretary. She helped me throughout the study by providing schedules, documents, announcements, appointments, and time change notifications. Electronic mail allowed direct access to the director which was important because I was geographically separated from the research site by sixty miles.

Human Subject Review Board

Part of the process for performing research in this setting required requesting an exemption from the Human Subjects Committee Review board based on the qualification outlined in The Ohio State University Human Subjects Program Guidelines handbook. Specifically, item one of the "Activities Exempt" appendix covered "research conducted in established or commonly accepted educational settings." According to the same guidelines, I produced a letter of consent for each participant's signature, which ensured that each understood the research agenda and confidentiality of the data. The consent letter also requested permission to

take notes, and to video and audio tape interviews and class sessions.

Pilot Study

Access and initial interest in PBL occurred in the Spring 1992 academic quarter. The following Summer I completed a PBL literature review and made plans for a pilot study. The study was scheduled for the Winter quarter, leaving the Fall quarter to study qualitative research methodology and to develop a strategy for my research.

The pilot study was used to develop a detailed description of the study setting and learn about the research process. It was used to learn how to present myself in the setting, explore likely problems, and test interview and observation skills (Glesne & Peshkin, 1992). In addition to serving as my introduction to the field, the pilot study doubled as my introduction to the students of PBLP-I.

This "entry into the field," as Patton (1990, p. 250) calls it, occurred by visiting each of the four PBLP-I groups during one of their Winter quarter sessions. Each group was comprised of six students and two facilitators. During my visit I introduced myself and practiced observing and taking field notes on a notebook computer.

The pilot study afforded an opportunity to explain the research briefly. Preparation for the explanation was crafted using Bogdan and Biklen's (1992) recommendation to answer the following questions before going into the site: "1) What are you actually going to do?, 2) Will you be disruptive?, 3) What are you going to do with your findings?, 4) Why us?, and 5) What will we get out of this?" (p. 83-84). In hindsight, preparing answers to these questions before the pilot study was of great value. It boosted my confidence, helped me focus, and built rapport with the participants. "Rapport," say Glesne and Peshkin (1992), "is a distance-reducing, anxiety-quieting, trust-building mechanism that primarily serves the interest of the researcher" (p. 94).

The initial impressions from this early experience were positive. Because the PBLP is an experimental curriculum, the students were acclimated to having visitors in the session. Their relaxed attitude about visitors made entry into the group less stressful.

Several advantages resulted from conducting a pilot study prior to actual data gathering. One of the best advantages was establishing rapport with the students. Patton (1990) addresses this issue specifically:

Published reports of researcher's entry experiences describe seemingly unlimited contingencies which may be encountered, ranging from being gleefully accepted to being thrown out

on one's ear. But there is a more subtle reason why the matter of one's entrance to a research setting is seen as so important. This concerns the relationship between the initial entry to the setting and the validity of the data that is subsequently collected (pp. 252-253).

Although the students would be assigned to newly formed groups in the next quarter, the pilot study made "entry" into the next quarter easy, regardless of how the groups were reformed.

The pilot study visits served as a baptismal experience for introduction to the students and to the PBL process. The PBL group process was exciting and energizing to witness. The first impression was, "Wow, I would love a class like this." Everyone seemed excited to be there; each had bits of information from their previous nights' independent study they wanted to share or ask about. The atmosphere was electric and alive; I could feel their enthusiasm and interest. It was exhilarating!

The pilot study highlighted the difficulty of keeping adequate field notes while trying to pay attention to everything simultaneously. It allowed development of logistics for getting to the site, parking, navigating to the classroom, and setting up. It provided an opportunity to establish a standard document format and file-naming scheme that served well throughout the data analysis, facilitated working out a strategy to deal with observational notes, and gave opportunities to ask for

journal volunteers. It also provided four sets of observational notes used to make decisions about coding, determining what's observable, and creating a system to enter observations into field notes.

Another part of the pilot study involved producing a paper describing the study setting. Initiated by one of my advisors, and discussed in greater detail in Chapter IV, the setting description paper became an important part of the research efforts. The paper was constructed using interview, observations, and documents.

The interviews included two arranged discussions with the director and a PBLP student, in addition to fifteen informal conversations with other PBLP staff and students. The observations were accomplished through visiting of the four PBLP groups during a group session and through a walking tour of the PBLP classrooms, study area, and administration spaces. Finally, the documents examined for the paper were handbooks developed by the PBLP Director, addressed to students, facilitators, and case authors.

In summary, the pilot study served as preparation for immersion into the research setting. It resulted in helping revise my plans, shape early interview questions, survey participants for journal writers, and enable me to "live in" and describe the setting. Because of the pilot study,

entering the setting was done with confidence and understanding.

Sample Selection

Rationale for sampling strategies in qualitative research lies in selecting information-rich cases. To that end this research used purposeful sampling (Patton, 1990, p. 169). Also, the selected group could also be considered a "typical case" or "homogeneous" (Patton, 1990, p. 173) sample, since the groups consist of members highly screened and uniquely qualified for this program.

In regard to sample size Patton (1990) says:

Sample size adequacy, like all aspects of research, is subject to peer review, consensual validation, and judgment. What is crucial is that the sampling procedures and decisions be fully described, explained, and justified so that information users and peer reviewers have the appropriate context for judging the sample (p. 186).

Following Patton's recommendation, the rest of this section presents site selection, unit of analysis, group selection, and participant selection in description/justification format.

Site selection was mandated by the topic. To my knowledge no other Colleges at the University are using a problem based learning format. This made site selection a given.

The unit of analysis was the intact group, since the PBLP is functionally organized into small groups of six students and two facilitators. Other options could have included individual students across groups or multiple groups, but these designs would have been problematic logistically and provided no advantage in selecting information-rich cases.

Group selection was also limited by the program organization to a field of eight groups. PBLP groups are stratified by year, half being first year students, called PBLP-I, and half being second year students, called PBLP-II. Choosing which group to work with involved a three step process.

The first step resulted in choosing to work with the PBLP-I students for the following reasons. PBLP-I groups meet more times per week than PBLP-II (three verses two), yielding a thicker body of data in keeping with the qualitative tenet of data saturation. In addition, PBLP-I groups are still developing their understanding and habits, while PBLP-II groups are already enculturated to the process and less in touch with its uniqueness.

The next step was a determination to concentrate on only one of the four PBLP-I groups for two reasons. First, scheduling constraints would not permit full time study of more than one group at a time. Second, members of the

groups were sufficiently homogeneous that selecting more than one group would have ultimately yielded the same data.

In the final step, purposeful sampling was used to select which of the four groups to spend the quarter with. The sample was selected through an evaluation of personal, group, and director exigencies. The use of these criteria is justified because of students' homogeneity in program experience, medical school selection, and method of assignment to group. The result of selecting based on exigencies was to select the group that had the best schedule fit. This strategy was validated through peers, advisor, and PBLP director review.

PBLP students are all volunteers, which effectively eliminates random selection. Selection into groups is done each quarter by the PBLP director. His strategy attempts to put each student with as many other students in the program as possible, and to mix age, gender, experience, and ethnicity to the greatest degree possible. He designed this strategy to optimize interactions of different personalities and styles.

In addition to the main research group, three opportunistic samples (Patton, 1990, p. 179), targeting the three other PBLP-I groups, were collected. Each group was visited during one of their sessions. By coding the observation from the opportunistic samples and comparing

them with the codes from the select group disparities, missing codes or incongruence between the PBLP-I could be checked.

In summary, sample selection was done in accordance with qualitative research methodology suggestions, site particulars, and "consensual validation" (Patton, 1990, p. 186) of peers, advisor, and PBL director. The sample selected is purposeful, typical, information-rich, and homogeneous. The sample has been described and justified in relation to site selection, unit of analysis, group selection, and participant selection.

Data Collection Techniques

To ensure trustworthiness, multiple data collection techniques were used. These methods are designed to check the accuracy and consistency of findings, and to produce data saturation. Bogdan and Biklen (1992) claim data saturation ensures the credibility, transferability, dependability, and confirmability of the study's findings (p. 68; also see Guba, 1981, pp. 83-88). Eisner (1991), has much to say about the role of multiple sources of evidence in qualitative research. He uses the term "structural corroboration" (p. 55) to talk about finding evidence that supports conclusions, and says the "use of multiple types of data is one way to foster credibility" (p. 110).

Eisner (1991) says, "one needs to put together a constellation of bits and pieces of evidence that substantiate the conclusions one wants to draw" (p. 31). The totality of these methods using multiple data sources and multiple collection techniques is designed to overcome intrinsic bias, validate information, and cross-check findings to represent what he calls a "transactive account" (Eisner, 1991, p. 53). A transactive account is a state existing at the intersection of the objective and subjective realms of reality, where truth and theory mesh to make what is.

Based on this genre, four techniques traditionally associated with the qualitative approach were used. They include: (a) prolonged and persistent participant observation, (b) informal interviewing, (c) public and private documents, and (d) video taping (Patton, 1990, p. 244; Glesne & Peshkin, 1992, p. 24). These techniques are presented in the following sections.

Prolonged and Persistent Participant Observation

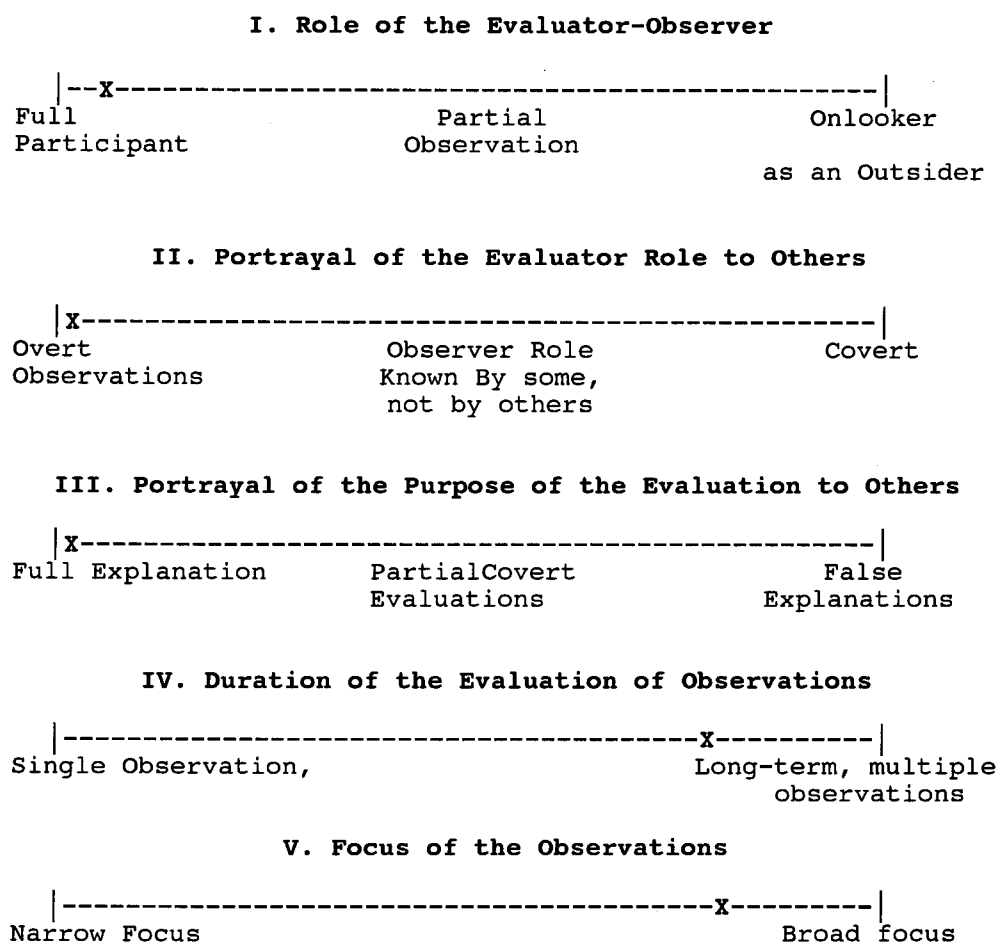
Prolonged and persistent participant observation was the primary data collection process. Many authors describe participant observation as a continuum, with participation at one end and observation at the other (Bogdan & Biklen, 1992, p. 88; Glesne & Peshkin, 1992, p. 40). However, my

experience was more in line with a chart developed by Patton (1991) that outlines participant and/or observation dimension continua (Table 7). The "X" on each continuum line represents my style in a graphic way.

This chart is not an exact fit, however. Dimensions II, III, and IV are static, self-explanatory, and fit the research model well; but dimensions I and V require some comment. The role of the evaluator-observer, instead of being a full participant observer, was to more of a full observer and less a full participant. Not studying the identified learning issues between sessions, and a general lack of medical knowledge, interfered with being a full participant. However, qualitative authors caution that it is best to stay away from studying areas where one is knowledgeable, emotionally involved, or somehow biased (Bogdan & Biklen, 1992; Glesne & Peshkin, 1992; and Patton, 1991).

Likewise, the literature suggests that increased participation could affect the research effort in other ways.

Table 7
Participant and Observation Continuum Chart



Note. Qualitative Evaluation and Research Methods (p. 217)
by M. Q. Patton, 1990, CA: Sage Press.

This caution is aptly described by Glesne and Peshkin (1991), who state:

The more you function as a member of the everyday world of the researched, the more you risk losing the eye of the uninvolved outsider (p. 40).

In Glesne and Peshkin's terms, minimal participation makes for more of an "observer as participant (primarily observer) than "participant as observer" (primarily participant).

Dimension V is also difficult to place on a static continuum. The inductive nature of qualitative research creates a situation where the focus starts out broad but narrows as the study continues, making it unrealistic to represent the focus with a static mark a continuum line. Although this study remains relatively broad, the focus did shift over the course of the research.

Observation data was collected in group sessions while sitting at the conference table with the students and facilitators. Arriving ten minutes before session gave time to set up. The classroom made being unobtrusive difficult, but the students seemed to adjust to my presence. There was no evidence that my presence was distracting, and casual dress was used to try to avoid drawing attention to myself.

During the fifth week of the quarter, observations were made on each of the other three PBLP-I groups. Since all four groups worked through the same cases, the observations were arranged so that coding between groups could be compared. This collaboration of findings fits the requirements of qualitative research.

Observations were entered directly into a laptop computer word processing program. File coding schemes that

identified the group (1-4), case number (1-10), and session on the case (i.e., GRP1_2_3 would be group one, case number two, third session) were used. Because of experiments during my pilot study, the LCD screen lighting was lowered but not blanked, as that might suggest secretiveness.

Typing and working in session felt conspicuous at first, especially true during silence, and the conspicuous feeling never totally disappeared. But it subsided after the first week and faded to near unconsciousness over the quarter. Other than these exceptions, the observational system worked well.

Informal Interview (Individual and Small Group)

A favorite data collection technique was the interview. Eleven individual student interviews were performed, as well as one facilitator and one group interview. The original plan was to conduct two interviews with each student; but three students had scheduling conflicts that cancelled their second interview.

The first student interview was designed to collect demographic information. An interview guide was used with a list of loose questions and probes in order to learn about the students' families, backgrounds, roads to medical school, and reasons for choosing PBL. The second student interview focused more on their perceptions of PBL and was

done using an informal conversational approach, characterized by naturally flowing conversation about a topic they selected (McCutcheon, 1994).

The group interview was done using an informal conversational approach and consisted of the sample group without the facilitators. The facilitators were not invited so that students would feel able to speak freely. The group interview was a bit problematic because it required passing the tape recorder around to each speaker.

The interviews were scheduled in advance and held in the group meeting room. It became a habit to arrive early, check equipment, arrange the room, and prepare my attitude for the interview. Interviews were a favorite tool because they did more to develop rapport than anything else. Aside from the hard work of transcribing, the interviews were enjoyable.

Public and Private Documents

Documents corroborate your observations and interview and thus make your findings more trustworthy (Glesne and Peshkin, 1992, p.52).

In their highly relevant section about document collection, Bogdan and Biklen (1992) differentiate between public and private documents, or, using their terms, "official documents" (p.132) and "personal documents" (p.135). They claim that each "presents one side of the

picture" (p. 137). This study used both official and personal documents.

Official documents provided historical, demographic, and program operation information. The main program documents included: (a) *The Student Handbook*, (b) *Facilitator's Guide*, and (c) *Guide to the Development of Problem-Based Learning Modules* (Curry, 1991a, b, and c). These documents contain information to indoctrinate and guide students, facilitators, and case writing teams. They are not extensive (about 50 pages each), but they are succinct and thorough enough to satisfy most questions about the program.

In addition, other documents included the ISP/PBL Weekly Bulletin, small group assignment sheets with group and session time assignments, a copy of a student Individual Process Assessment (IPA), the ten case modules minus the attachments, a PBLP program brochure, and a PBLP Facilitator-Student Conference Checklist. In most cases, these documents were discovered through conversations or seeing someone with one and seeking it out. In all, there was a rich source of public documents.

Personal documents were garnered through journal writer volunteers. Four students and a facilitator agreed to keep personal journals; one student and the facilitator decided late in the quarter, so their entries cover only the last five of the ten cases. Qualitative authors recommend a

researcher journal, but the expanded observation notes made that journal.

Journal volunteers were provided with a journal containing written instructions modeled after advice from *Writing to Grow: Keeping a Personal-Professional Journal* by Mary Holly (1989). In her introduction she writes:

Use the journal as a log of events and a place to "let it all out" but make sense of what is out. It is to be a place where the writer can carry on a dialogue with various dimensions of experience. What happened? What are the facts? What was my role? What feelings surrounded the event? What did I feel about what I did? Why? What was the setting? The steps involved? What were the important elements? What preceded the event? Followed? What might I be aware of if such a situation recurs (Introduction)?

In addition, journal entry heading formats were provided so the entries could be matched with other field notes.

Finally, a request was written asking them to write about any aspect of their observations, feelings, and experiences concerning the group session that they felt was appropriate.

Each week the journals were collected for review and comments or questions. Reading entries allowed inspection of insights with opportunity for soliciting clarification, or for more depth about the writers' observations. This was a great interactive tool. After reading weekly entries, a short "thank you" note was written to encourage them to be faithful and write about "what" they observed and "why" they think it is that way.

At the end of the quarter the journal entries were transcribed into word processing files, and then the journals were returned to the writers. The authors were assured their writing would be held in the strictest confidence. The journals were a great source data and access to them was a privilege.

Video Taping

Video taping was used to capture the scene and the sense of all that happened. It was used later for review to help describe a typical session. The classroom configuration forced camera placement in a far corner of the session room. Early arrival on video taping days allowed time for gathering equipment, set up, and testing.

Two complete cases covering seven two-hour sessions were video taped. Eighteen hours of video was judged to be enough to capture the session happenings, movements, and nuances for review. Session description was significantly improved by reliving the sessions through the video. Watching the video while describing the sessions helped give them what Eisner (1991) calls "experimental congruence" (p. 21).

Data Analysis Procedures

Analysis: The separation of an intellectual or substantial whole into its constituent parts for individual study to determine either its nature (qualitative analysis) or its proportions (quantitative analysis). (Websters, 1977)

Qualitative data analysis begins during data collection and continues after, usually at least as long as the original data collection period (Bogdan & Biklen, 1992; Glaser & Strauss, 1967; and Glesne & Peshkin, 1992). Therefore, data analysis for this study began with the pilot study and continued through final report. The systematic processes developed for the majority of data analysis was an eclectic method based on qualitative research methodology tenets, the computer programs used, and day-to-day successes or failures. Each collection method--prolonged and persistent participant observation, informal interviewing, public and private documents, and video taping yielded--different kinds of data, requiring a variety of analysis techniques.

The first collection method resulted in observation notes, and the second produced verbal protocols in the form of transcribed audio tapes. The third method resulted in two different kinds of data: personal notes from journals, and official documents. Finally, video taping yielded moving picture records. In order to describe the analysis of these different stocks, they will be discussed in turn,

closing with a description of how the data was correlated and collated together.

Observation Notes

Some analysis procedures were developed early in the study, such as the file coding conventions and the systematized checklist of things to do with each set of observational notes. Other processes came later with the hermeneutic task of classifying the data into assigned codes and reassembling it by those codes. Like the research itself, the data analysis was an inductive process that progressively made more sense as it was completed.

A checklist was developed for processing the observational notes after each session. First, the notes were read and expanded with thoughts and ideas. Expanded notes were then identified by isolating them with a box to distinguish them from the original field notes.

The following example of an observation note with an expanded note helps make this procedure vivid.

Mel: The armspan must be important or they wouldn't have put it in there.

I thought this was a clever thing to notice and it changes the way I will look at paper cases. I'm not sure they would have gotten this clue if they were in practice--I never remember anyone measuring my arms. Anyway, Mel noticed that this was an unusual thing to put on a physical exam report and keyed in on it. (page_rea.doc, p. 1)

The second checklist item was to back-up the electronic file and print out a hard copy. The hard copy was then formatted to have a two inch left margin allowing room for coding, which was the third step. Bogdan and Biklen's (1992) recommendation for coding is to "search through your data for regularities and patterns as well as for topics your data cover, and then you write down words and phrases to represent these topics and patterns. These words and phrases are coding categories" (p. 166).

The example observation above was coded "page reasoning" because the students used the page information to reason about the case. Interestingly, another student reacted to Mel's comment and figured out the patients' problem was genetic, putting several other students on the trail of genetics and extreme arm length. Within five observation notes, the students had developed a preliminary diagnosis of Klinefelter's disease. The ongoing coding process helped inform my research by letting me realize what I was seeing and think about what I had seen.

In summary, by beginning to analyze the data during the study, repeating themes appeared which further informed the observations. Several challenges arose concerning the coding and observation process. It was difficult to narrow the research focus over the ten weeks, and keeping up with the process was hard. Nonetheless, the observational notes

constituted the foremost data stock, and it was advantageous to code and print them out throughout the data collection period.

Transcribed Audio Tapes

Interviews yielded verbal protocols in the form of audio tape transcriptions. Each interview transcript became a separate file with a unique filename that identified it as an interview file and also allowed for the identification of the interviewee (e.g., INT_nnnx.DOC, where nnn = first three letters of name and x = 1 or 2, representing first or second interview). When transcription was finished, the files were printed in hard copy with a two inch margin, read, and coded.

Notes from Journals

Journal data was processed in the same way as the interview notes. After collection, the entries were transcribed into a word processing file, assigned unique filenames (e.g., JRN_nnnn.DOC, where nnnn = name), printed, and coded. The journal entry headings corresponded with the observational notes headings, allowing an additional insight on the session.

Official Documents

Public documents were another data source analyzed. They were read and studied for their information on the program. The main program documents provided an early understanding of the program before the pilot study. By reviewing the documents again at the end of data collection, they provided a deeper level of understanding than when first read.

Video Tape

The final data source analyzed were the video tapes. Since there was little distinguishable audio on the tapes, they were used to review the setting and refresh recollections of the actions within the sessions. Reviewing the tapes made the sessions come alive again and helped inform the session description and interpretation in a way that was more vivid. This was especially helpful, since the time between data collection and description of findings was about four months.

Collated Data

Collating the data files and their codes was the last analysis process. It began by producing a matrix of all the data to aid in seeing the big picture. The matrix was

produced on one legal size paper divided into 27 two-by-three inch rectangles, one for each group session. Each block contained the date, case, and session number corresponding to my field notes. The blocks also showed student roles and observation codes from the session. A one inch border around the matrix was used to jot down ideas and note patterns as the matrix was filled in. The back of each session block was used to fill in the codes generated through the personal journals. The matrix helped visualize the scope of the research, detect patterns, and quickly identify the groups day-by-day work over the entire quarter.

After the matrix was built, a four step process was used to correlate and collate the codes from the data. First, the coded data files were arranged in three ring binders chronologically by case and session. Second, the codes were entered into a spreadsheet--one code per row. This arrangement allowed case, session, source, and page number to be placed in the code row. Each of these elements had their own column, which allowed sorting while maintaining the integrity of the code with its information.

The third treatment involved sorting the codes by alphabetical order. This served to group all like codes together. The final step, the most arduous and time consuming, was extracting the rows of like codes into a new word processing file and then finding and extracting the

excerpt from the data files that generated the code. These new files were then saved using the code name.

Several excerpts follow to depict visually the final product of this process. The bold headings represent the code name or case number, page number, and source. The source identifies whether the code was extracted from observation, interview, or journal data files. If the code was extracted from either observation or journal, the header also includes the session number. Below the heading is the extracted data from the data file. The extracts within a box represent expanded notes added after the initial session. This convention is used throughout the rest of the report to identify data excerpt sources.

absence **Page 3** **int_mel2**

The thing I didn't like when the facilitators weren't there people said they felt freer. I didn't really feel a difference and I don't know why you should and I don't know if people have this authority thing like they can't be themselves around authority and that's stupid.

absence **Session3 Page 8** **Jrnl Gwin**

Dr. Curry and Dr. Wolfe will be absent. I suspect that it will be at least as productive as usual and that people will feel more comfortable speaking up.

absence (n's half day off) 136/7/2/2/observe

Mel: "I have a question, could somebody summarize what you talked about the last half of the class?"

Mel had to leave from the last session about an hour early. This had not happened before but it raises the issue of what to do with members who miss or can't keep up with the group for one reason or the other. . .

The correlating and collating process resulted in 72 code files with excerpts from every data file where the code appeared.

A final code analysis process was generating a spreadsheet to summarize the 72 codes. This file contains one code per row with columns to indicate code frequencies by overall total, journal total, interview total, observation total, and case total. This code count file allowed for quick sorting and to see how often each codes was noted (Table 8). Of course "the count" is not the ultimate way to decide which codes are important qualitatively, but they do suggest code relevance based upon the number of times a code appears and how many sources the code is found in (a triangulation principle).

Table 8
Code Count by Overall Total, Journal Total, Interview
Total, Observation Total, and Case Total

No.	Code	Total No.	No. Jn'l ^a	No. Int ^b	No. Obsr'd ^c	No. Cases Occr'd ^d
1	absence	6	2	2	2	3
2	adapt to pbl	3	3	0	0	3
3	admonishment	26	6	3	17	7
4	agenda	9	2	0	7	5
5	aha	9	1	0	8	5
6	anger	6	3	2	1	4
7	attention	11	1	1	9	5
8	attitude	2	1	1	0	1
9	board diagram/work	9	0	1	8	3
10	behavior science issue	34	5	5	24	9
11	call for info	20	0	0	20	8
12	case info	23	2	1	20	6
13	challenge	27	2	0	25	7
14	closure	10	0	1	9	7
15	collaborate	10	0	3	7	4
16	confusion	8	3	0	5	4
17	coverage	18	1	6	11	7
18	David experiment	10	1	2	7	5
19	disease vs basic sci	10	3	2	5	5
20	enrichment	3	0	2	1	1
21	eval where others are	12	0	2	10	6
22	evaluation	13	7	4	2	6
23	excitement	2	0	2	0	0
24	facilitator	104	29	9	66	9
25	feedback	26	10	8	8	7
26	fidelity	8	1	1	6	5
27	focus	18	0	0	18	6
28	frustrated	44	20	6	18	9
29	future talk	10	3	2	5	7
30	group work	118	34	9	75	10
31	guys	1	0	0	1	1
32	humor	43	4	2	37	9
33	hypothesis vs diagnosis	7	0	0	7	6
34	idea	7	0	0	7	6
35	independent study	13	3	5	5	4
36	lack case info	21	0	1	20	9
37	lack of knowledge	8	3	0	5	6
38	leader	25	7	7	11	8
39	learning issue	97	10	9	78	10
40	movement	5	0	0	5	5

(table continued)

Table 8 (continued)

No.	Code	Total No.	No. Jn'l ^a	No. Int ^b	No. Obsr'd ^c	No. Cases Occr'd ^d
41	negative direction	4	0	0	4	2
42	non-verbal	3	0	0	3	2
43	note	5	0	0	5	3
44	pace	15	7	2	6	8
45	page confusion/reasoning	6	0	0	6	4
46	participation	22	10	5	6	7
47	PBL process/described	28	8	17	3	5
48	personal experience	46	8	0	38	8
49	personalities	21	16	5	0	7
50	preparation/presentation	28	13	3	10	8
51	question	35	5	2	30	7
52	read aloud/silent	86	1	2	83	10
53	relationships	5	4	1	0	3
54	researcher affects	2	0	2	0	0
55	resource	68	1	2	65	10
56	responsibility	7	3	4	0	2
57	role	26	3	1	22	10
58	scribe	19	1	0	18	7
59	silence	2	1	0	1	2
60	social chatter	2	1	0	1	2
61	springboard	2	0	0	2	2
62	study method	7	1	5	1	2
63	teach	24	2	1	21	10
64	terminology struggle	16	0	0	16	7
65	time flex	4	1	3	0	1
66	transfer	3	0	0	3	3
67	USMLE	6	0	2	4	2
68	verbalization	12	0	0	12	6
69	visitors	4	4	0	0	2
70	volume/confidence	2	0	0	2	2
71	why PBL	6	0	6	0	056
72	wrap-up	5	1	3	1	157

Note. a. journal
b. interview
c. observed
d. occurred

Peer Reviews and Member Checks

The last analysis process was accomplished through peer reviews and member checks. Two fellow graduate students reviewed the writing, checking it for coherence and providing some feedback. In addition, my advisors checked the ongoing and provided valuable feedback. Finally, feedback was solicited from students in the study on the accuracy of the findings. Two students took the time to read through portions of the study and they judged it to be true to both the setting and their experience.

Data Analysis Procedures Summary and Conclusion

The study methodology is based upon the tenets of the qualitative research paradigm. The rationale is grounded through a small literature base containing almost exclusively quantitative studies with inconclusive findings. It is also warranted by the PBL research domain that resists decontextualization.

Access to the research was facilitated by the PBL director, the PBL secretary, and the openness of the students to visitors in their group session. A pilot study was used as a pre-study tool to work out the method parameters, to collect data, and to get acquainted with the

PBLP staff and students. A purposeful sample strategy was used for selecting information-rich cases.

The data collection procedures included prolonged and persistent observation with a hint of participation. In addition, both formal and informal interviews, personal journals, and video tapings were employed to collect the research data. The data were collected over a ten week period, which was judged to yield sufficient data saturation for obtaining valid results.

Analysis of the generated data was accomplished through computer files used to count, correlate, and collate them. The analysis process resulted in a matrix showing the research group's work over the whole quarter, and 72 codes from the combined data files. Finally, the data and write-up were scrutinized by peers and research members for coherence, consensus, and instrumental utility.

The methods of qualitative research force the development of relationships with the research participants and the process. Many lessons were learned about myself and qualitative researching through this study. Developing a comfort with entering other domains, and challenging the full perception faculties, are both experiences that must be practiced. This methodology gives new ways of knowing, or, in Eisner's (1991) words, "epistemic sight ... awareness of

the qualities of voice, manner, movement, and visual environment" (p. 68).

CHAPTER IV

PROGRAM AND PARTICIPANT DESCRIPTION

Introduction

The authors of PBL meta-analyses discovered first hand a key problem in studying this innovative curriculum: heterogeneity. Vernon and Blake (1993) state:

Conducting high-quality evaluative research on PBL has been difficult for a variety of reasons. The independent variable, PBL, is more than a simple teaching method. It is better described as a complex mixture of a general teaching philosophy, learning objectives and goals, and faculty attitudes and values, all of which are difficult to regulate and are often not very well defined in research reports (p. 560).

Albanese and Mitchell (1993) say in their conclusions that,

Since there is such diversity in what different individuals call PBL, institutional idiosyncrasies loom large. We suggest that future research should attempt to document more concretely the types of PBL approaches being used in the various curricula (p. 78).

Likewise, Bickley (1993) comments in a letter to the editor about PBL meta-analyses in general, "PBL curricula today are still experimental and heterogeneous (in the extreme)" (p. 545). These authors are all announcing the need for PBL researchers to be very clear about the PBL program under investigation.

The Barrows (1985) and Barrows and Tamblyn's (1980) model is used by every program found in the literature. However, there are many variables designed to meet local needs. These program variables, such as problem designs, assessment, and participant roles, can change the nature of the curriculum in significant ways. However, if these variables are conscientiously described they can be used to define and discriminate when reading, searching, comparing, and evaluating PBL programs.

The parameters explained below are designed to enable that discrimination. This chapter begins with a description the Problem-Based Learning Pathway (PBLP) program at The Ohio State University (OSU), including an official and unofficial definition, historical background, program administration, case development design, participant roles, group make-up, general group session process, and assessment. Described next are the PBLP physical spaces of the administrative, group, and student areas. Last are study participant introductions. These descriptions represent a synthesis of evidence from several methodological procedures (Table 9).

Table 9
Sources of Resource Evidence

	<u>Interview</u>	<u>Observation</u>	<u>Document Analysis^a</u>
PBLP Definition	X		X
Historical Background	X		
Administration	X	X	X
Cases design	X	X	X
Participant Roles	X	X	X
Group Make-up		X	X
Group process	X	X	X
Assessment			X
Physical Spaces		X	
Participants	X	X	

Note. a. Document Analysis--private journals and public documents.

Program Description

Descriptive Definitions

Several authentic participant quotes serve to describe the operational meaning of the PBLP program according to those experiencing it. The quotes come from the PBLP program documents (Curry 1991a, 1991b, 1991c) and a student interview. Dr. John J. Curry, the PBLP director, describes the program this way:

The Problem-Based Learning Pathway is a curriculum for the first two years of medical school in which the passive delivery of information has been almost completely eliminated. Instead, students

are placed in small groups of six each. Each group meets with a faculty facilitator for two hours, three times per week. The faculty do not teach but serve to facilitate discussion in the group and to provide instructional materials when called for.

A series of cases serve as a basis for learning the basic science. The objective is not to diagnose the case, but to use it to identify "learning issues," topics for further independent and/or group study which must be learned in order to understand the patient's problems. Students then work independently on their learning issues before the next meeting, at which time the new information is discussed and refined in the context of the case. If necessary, further learning issues are then identified and studied.

The overall goal of the program is to emphasize problem-based, student-centered, self-directed learning, rather than teaching and to emphasize the development of attitudes and skills which stress the acquisition of new knowledge rather than the memorization of isolated facts. In the Problem-Based Learning Pathway, the students take personal responsibility for their own learning, as they acquire relevant and flexible knowledge base. They develop a commitment to life-long learning, gain an early proficiency at clinical reasoning, improve their interpersonal skills and, in general, become better prepared for entry into clinical clerkships (Curry, 1991b, p. 3).

For a different perspective, a student was asked to explain how he describes the PBLP to curious relatives and interested persons:

I describe it as problem based learning where you're not studying the traditional route of sitting in a lecture. I describe it as a group of people who meet and discuss ideas, teach each other; and I identify where they are weak and what topics they do not understand. I describe it as a very encouraging atmosphere where everybody gets the benefit, everybody gets opportunity for equal participation which makes learning a lot more active. It's the opposite of passive learning (Will interview, p. 1).

These definitions provide a starting point for depicting the PBLP. They portray a program fitting well within the broad general characteristics of the PBL tenets described in earlier chapters.

Historical Background

PBLP at OSU is the result of one individual and several turns of events. It started about eight years ago (1986) when Dr. Curry was selected by his department to take a "turn" at filling the director position, which typically rotates between all departments. As he explains it, he entered the position on the heels of two significant events.

The first was the 1984 Report of the Project Panel on the General Professional Education of the Physician (known as the GPEP report). The second was the Liaison Committee for Medical Education (LCME), the accrediting body for medical schools. Then, in addition to his directorship and these reports, a new faculty member came to OSU from Tufts University, an institution using problem-based learning. Taken together, these circumstances merged to spawn the experimental PBLP at OSU.

When Dr. Curry read the GPEP report (published two years prior to his directorship), he said he had an "Aha experience" and "homed in on ... the difference between active and passive learning and ... the concept of problem

solving skills" (Curry interview, p. 4). He said "at one time I did 60% of the lectures in the physiology course ... I've always had the feeling that I wasn't really totally happy with lectures, there had to be something more than that" (Curry interview, p. 1).

The second report, the LCME, was published just before Dr. Curry began his term. It reported that the medical school received a provisional accreditation based on a lack of integration. In explaining the significance of this event Dr. Curry notes,

The major criticism [of the LCME] was that there was not enough integration of the material. When talking with students, the students were saying it's very difficult when nothing correlates with anything else.

What the provisional meant was that instead of being accredited for the whole seven years, they were going to come back in three or four years and see if you've address their concerns (Curry interview, pp. 3 & 5).

The LCME then was the major catalyst for beginning something new. It was at this time he "put into the program what I called problem solving sessions, although I knew nothing about problem-based learning at the time" (Curry interview, p. 3).

His early attempts to introduce problem solving sessions into the curriculum did not meet with much success. Dr. Curry describes what happened next:

About that time somebody came from Tuft's where they were doing problem-based learning. He knew I was trying to put this into the lecture and he had

come with this experience and wanted to get involved in it.

He explained the process to me. . . . That got me excited about it and I started. I became director and started going to AAMC meetings and CGA meetings ... doing problem-based learning workshops. But ... nothing was happening around here, nobody else knew anything about it.

After one year I decided I needed to see how and if I can do it and how it's going to work. It was at that point, maybe in my second or third year [1988/89] as director I went to the MED PATH people (Curry interview, p. 5 & 6).

The Med Path is a summer pre-entry program that exists to give prospective students refresher courses on basic anatomy, physiology, and biochemistry before starting their first year of medical school. Dr. Curry went to them with the idea of "doing some case based stuff" (Curry interview, p. 7). He said he received permission to try it on one condition, "just as long as he didn't interfere with what they were doing" (Curry interview, p. 7).

With that permission Dr. Curry took the opportunity to try out his ideas:

We did it that Summer. I got comfortable with it and learned a lot from it. And then the students were excited about it, they loved [it] because it was different . . . So they made a big deal of it and the next summer they came and asked me if I would do it again (Curry interview, p. 8).

Word about the program slowly spread, and after four years the possibility of starting a PBL program was added to the agenda of a curriculum review retreat.

Curriculum retreats occur once every two or three years to address issues of importance concerning the medical

college curriculum. Typically, working groups are assigned two or three months before the retreat to research specific topics so they can make recommendations on the curriculum changes they have been studying.

Dr. Curry was asked to chair a group on the PBLP but declined because of his vested interest. However, he worked closely with his new colleague from Tuft's who did chair the group. Together, they described Dr. Curry's PBL experiments and his lessons from them of the past few years. The presentation at the retreat resulted in a decision allowing Dr. Curry to move forward with a plan to create an experimental problem-based learning pathway for the first two years of medical school.

That was three years ago. Now, the program is well established, building a reputation for producing quality students well-prepared to move into the clinical rotations of the third and forth years of medical school. In fact, the first two classes who have "graduated" from the PBLP passed their medical board exams with scores above the national average. Dr. Curry considered this a major hurdle because the main criticism of the PBLP was concern about students getting the foundational medical knowledge needed to perform well on the medical board exams.

Administration

The PBLP is administered by the director, an assistant director, one secretary, and the students. The director arranges the students into groups and then students, facilitators, and secretary work together to arrange schedules and meeting place. The director also handles admission, student assessment, case management, facilitator training, scheduling, student counseling, and general PBLP proselytizing.

The secretary maintains student information, publishes a weekly PBLP bulletin, coordinates end of quarter exams, and maintains a chart that tracks each PBLP group's progress through the assigned cases. She also runs interference for the director, keeping track of his schedule, making and fielding calls, and producing letters and memos. It is a constant struggle to keep up with the demands of the program and its forty-eight students.

Case Development

PBLP cases are developed using the Barrow's progressive disclosure model (Table 10). Faculty and staff form "case teams" and develop case modules using a guide developed by Dr. Curry (Curry, 1991a). The guide is a "how-to" manual

Table 10
General Plan for a Problem-Based Learning Module

Part I - Students and Facilitators

- Page 1 * Case Presentation
 (Name, sex, age, and complaint)
- Page 2 * Results of initial interview
 Answers to possible questions
 History of present illness
 Past Medical history
 Social and family histories
- Page 3 * Results of Physical examination
 Vital signs
 Results of appropriate systemic exams
- Page 4 * Additional patient information
 Thru Laboratory and diagnostic test results
 Page n Any appropriate X-rays, MRI scans, EKGs
 Any other relevant facts and findings

Part II - Facilitators Only

- Apdx 1 * Abstract
 Summary of case
 Suggested leading questions to raise issues
- Apdx 2 * Suggested possible learning issues
 Basic sciences
 Clinical sciences
 Behavioral Sciences
- Apdx 3 * Suggested timing and break points
 Suggested duration of case in sessions
 Suggested pages covered in each session
 Important learning issues for each session
- Apdx 4 * Module evaluation
 Learning issues not addressed
 Unlisted learning issues addressed
 Confusing or unclear points
 Information requested but not provided
 Suggestions for improvement

Note. A Guide to the Development of Problem-based Learning Modules (Case Writing) (p. 19) by J. Curry, 1991, College of Medicine, The Ohio State University.

explaining the construction of a complete problem-based learning module (PBLM).

A PBLM consists of a problem case spread over several pages, an abstract, possible learning issues, suggested timing, case visuals, and forms to log generated learning issues and evaluate the case. Building PBLMs locally allows students to consult case writers and gets more faculty involved in the PBL process. The case writing teams are composed of clinicians in related fields, basic scientists from various departments, social and behavioral scientists, and the program administrator.

The primary case author is the doctor or clinician who handled the case. Working with a team, they decide on the relevant patient information and construct a total PBLM. This process is aided by case-writing worksheets supplied in the writing guide.

The number of PBLMs available exceeds the number a PBLP group can do during the program. The PBLMs are conscientiously rotated and updated to keep the facilitators fresh and to infuse the latest medical knowledge into the cases. Each PBLM is critically evaluated every time it is used, and the feedback from students and facilitators is used to improve them.

PBLM administration is straight forward. Before each quarter the director purposefully selects a series of

increasingly difficult PBLMs. He selects PBLMs that emphasize increased levels of difficulty and cover a wide range of problems. Often his strategy includes several cases on the same organ, such as on the liver or heart. In this way students may repeat some learning issues and cover them in more depth the second time through.

Opportunities to repeat learning issues also help students to review some learning issues already covered and to select others that may have been passed over. The facilitators' guide states, "[t]he list of learning issues identified in the appendix of each [PBLM] is exhaustive. . . . There is a tendency for most learning issues to come up several times over the course of the program" (Curry, 1991a, p. 35). PBLM development, maintenance, and use are all processes requiring time, careful planning, and critical ongoing evaluation.

Participant Roles

To understand the PBLP process it is helpful to know the roles of the participants. Since this is a description of the OSU PBLP program in particular, this section draws heavily from the program documents outlining these roles. The participants' roles include (a) the role of the facilitator, (b) the role of the students as group members, and (c) the role of students as individuals. The next

section describes these roles, followed by a description of acronyms developed to help students and facilitators play them.

Each group is facilitated by two faculty members--a clinician and a basic scientist. The facilitators stay with their group throughout the quarter but are reassigned to a different group each subsequent quarter. The facilitators in this program are all volunteers.

Facilitators have a variety of explicit roles and functions to perform. The facilitators' duties include:

1. Organizing the group and establishing a comfortable atmosphere at the initial meeting.
2. Assuring that the group starts each meeting with having someone volunteer to be a reader and a recorder.
3. Distributing case materials at the appropriate time.
4. Assuring that each group session ends with a self-evaluation.
5. Keeping the group focused on their goal.
6. Monitoring the discussion and keeping records.
7. Stimulating and manipulating the group with carefully worded and selected open questions.
8. Evaluating student performance and participation.
9. Evaluating the Problem-Based Learning Modules (Curry, 1991b, pp. 26-28)

The *Facilitator's Guide* offers suggestions on intervention for situations such as a group losing sight of its goal, a

sluggish group, a hostile group, a non-critical group, timid or domineering students, and the division of labor problems. It also offers suggestions concerning good group processes, how to participate without taking control, and specific facilitator "do's and don'ts" such as:

Do:

- * Insist that the students take and maintain control of the discussion. Respond to direct questions in a way that passes control back to the students rather than with a direct answer;
- * Asking open, very general, or even vague questions which will stimulate the students to probe deeper into a topic, or to redirect themselves;
- * Be patient, particularly during earlier stages of the curriculum when they may have to stumble around a little before beginning to find their way; give them ample opportunity to get on track on their own; and
- * Foster critical thinking; encourage the students to challenge one another on information they are providing and reassure them that they are not being personally impugned [attacked] when they are challenged.

Don't:

- * Jump in just to break a silence;
- * Answer direct questions with direct answers;
- * Suggest topics for discussion;
- * Tell the students whether a direction they are pursuing is right or wrong; and
- * Direct the group to add a particular learning issue to their list. (Curry, 1991b, pp. 29-35)

The PBLP students have several complex roles to play. As an active group member, students have the responsibility to give and accept constructive criticism, admit knowledge deficiencies, and complete their independent studies. They

are also to evaluate honestly group activities with regard to themselves, the group, and the facilitators.

Other roles the students play are volunteer roles falling into two categories: simulated and functional. The simulated roles consist of role playing a doctor or a patient when a new case is presented. The "doctor" interviews the "patient" in a simulation of actual practice. These roles are normally only done once at the beginning of case--first day, first session, first hour.

The functional roles students serve are volunteer positions with different levels of responsibility. The volunteer roles rotate each session and include a reader, scribe, presenter, and resource person. The reader is responsible for reading aloud the pages distributed by the facilitators which reveal increasing amounts of case information. The challenge for the reader is terminology, i.e., pronouncing unfamiliar terms and words. Other than that, this role does not require any extra effort on the part of the volunteer.

The scribe serves to write the facts, questions, hypotheses, and learning issues on the board during session. This role requires analysis and attention to detail, summarizing and clarifying skills, and negotiation skills. The scribe spends most of the session on his or her feet and

has the added responsibility presenting the case at the next session.

The presenter is always the previous sessions scribe and is responsible for providing a summary of the case to date. This involves summarizing the previous day's work in clinical terms by describing the patient, major complaint, and relevant case data. Although short lived, the presentation is critical to the group's work and requires extra effort between sessions and in the next session.

Finally, one person is charged with bringing the resource books to sessions. For my group, the resources were in a canvas bag and consisted of about five two-inch-thick medical reference manuals. This job was not cognitively demanding, but called for responsibility since the references were so necessary.

The director developed numerous acronyms to aid the participants in understanding and remembering the role requirements. These mnemonic acronyms were created to trigger memories and keep the process moving smoothly (Table 11). Taken together, these acronyms overview suggestions about how to think about the PBLP curriculum and provide clues about curriculum areas that need specific shaping. While acronyms are not guaranteed to serve as a guide, they attempt to instantiate the clinical reasoning process born

Table 11
Mnemonic Acronyms Used in the OSU PBLP

<u>Acronym</u>	<u>Description</u>
ROPES	For aspects of group dynamics: <u>R</u> isk, <u>O</u> penness, <u>P</u> articipation, <u>E</u> xperience, <u>S</u> ensitivity.
HOPI	For taking a patient history of the present illness: <u>H</u> istory <u>O</u> f <u>P</u> resent <u>I</u> llness.
CODIERS	For inquiries on present illness: <u>C</u> hronology, <u>O</u> nset, <u>D</u> escription/duration, <u>I</u> ntensity, <u>E</u> xacerbation, <u>R</u> emission, <u>S</u> ocial/psychological.
PMH	For inquiries on past medical history: <u>P</u> ast <u>M</u> edical <u>H</u> istory
MMASH	For inquiries on specific PMH. <u>M</u> edical <u>I</u> llnesses, <u>M</u> edications, <u>A</u> llergies, <u>S</u> urgeries, <u>H</u> ospitalizations
PQRSTU	For information on complaints associated with pain. <u>P</u> rovoke/palliate, <u>Q</u> uality, <u>R</u> egion/radiation, <u>S</u> everity, <u>T</u> emporal properties, <u>U</u> nusual <u>C</u> orrelates
"VINDICATE+P"	For identifying causal categories across body systems. <u>V</u> ascular, <u>I</u> nflammatory/infectious, <u>N</u> eoplastic, <u>D</u> egenerative, <u>I</u> ntoxication/toxic, <u>C</u> ongenital, <u>A</u> llergic/autoimmune, <u>T</u> raumatic, <u>E</u> ndocrine/metabolic, and <u>P</u> sychosomatic

Note. Student Handbook (pp. 13, 17-18, 20) by J. Curry,
1991, College of Medicine, The Ohio State University.

out of literature and identified as the scientific
method of the physician (Curry 1991a, 1991b).

The roles and acronyms presented here represent explicit attempts to define expectations of program participants. They do not, however, address the more complicated matter of implicit roles played by the participants, such as student, facilitator, group member, friend, teacher, evaluator, individual, associate, partner, scientist, or future doctor. These implicit roles are shaped through the context of the program as the students are socially engaged with each other and the curriculum.

Group Make-up

The description of group make-up is somewhat redundant of the "Sample Selection" section in Chapter III. However, it is presented here in more detail. Group make-up comprises two critical steps; (a) selection to the PBLP program, and (b) selection to a group. Neither is quite as simple as it appears on paper, but the mechanics of selection serve to illuminate the process.

The PBLP at OSU is still in its infancy and is considered an experimental curriculum. As such it has few staff members, and the size of the program is limited to twenty-four students in each year's group (PBLP-I and PBLP-II). Students are selected into the program based on their desire to participate and the timeliness of their application.

Selection is on a first come, first served basis. Most students learn of the PBLP when they come to the College for orientation, which includes a briefing on the PBLP. After selection to the program, they are separated into four groups of six students each.

The groups are reformed each subsequent quarter. The director attempts to rearrange groups purposefully to maximize student exposure to each other while minimizing repeat grouping, and to optimize interactions of different personalities and styles.

Group Session Process

PBLP-I and PBLP-II groups meet three and two times a week respectively, for three hours each. The meetings are called sessions, and it takes a group an average of three sessions to cover one case. A group can typically cover ten cases over the ten-week quarter.

A three-phase cyclic process guides the group through a case: (a) introduction and work on the case, (b) independent study, and (c) revisiting the case with new knowledge. This process continues until the case is complete. It starts when the group agrees they are ready for a new case. Asking for a new case sometimes occurs during a session, but often it falls naturally at the start of a new session. Once

called for, the first page is distributed and the major complaint is read.

Group Session Phases

In phase one pages are read, and pertinent information is scribed on the blackboard. The blackboard is divided into four columns for (a) facts, (b) general ideas and questions, (c) hypotheses, and (d) learning issues. The group decides which facts are important and lists them as they are read and discussed. This group work includes probing one's own mind and each others' minds for scientific explanations and correlative information relating to the problem. Throughout the process, students are to challenge any information presented for accuracy and understanding.

Eventually, the ideas listed on the board are formulated into hypotheses to be tested. With each hypothesis, learning issues (topics about which there is insufficient knowledge to understand) are identified. At the conclusion of the session, the group collectively selects the learning issues to pursue during their time of independent study and suggests resources to obtain needed information. The final session activity is a group self-evaluation to discuss the group process and recommend improvements or changes.

In the second phase, students engage in "independent study" as they address the selected learning issues.

Appropriate resources for their independent study include textbooks, journals, microscope slides, X-rays and scans, audio-visual materials, and human resources. "The term 'independent study' is meant in the broadest sense to mean any activity outside the small group meeting" (Curry 1991c, p 10). Students are permitted and encouraged to work in teams or groups with their own members or members of other groups or tracks.

Reconvening, saturated with case related knowledge, begins phase three. The students discuss their newly acquired knowledge and evaluate their previously formulated hypotheses, recycling through their earlier decisions. After their discussion and before any new pages are received, the scribe from the previous session delivers a synopsis of the case. This process emulates the activity of a clinician on hospital rounds and serves to prepare students for future clinical rotations.

Discussion of learning issues and case presentation is followed by additional pages of new information, and the cycle continues. The process is repeated several times during a case. A case is considered completed when the group is satisfied it has gained sufficient knowledge of the basic scientific mechanisms underlying the patient problem. Upon ending a case the group performs a final evaluation of

its activities and summarizes what's learned (Curry, 1991c pp. 4-6).

Page Revelation

The use of a page disclosure method creates a second order process at work within phases 1) and 3). Page one is given to everyone simultaneously. It is typically a one sentence "major complaint" (e.g. Betty Bored, a 41 year-old women, comes to the emergency room complaining of a pain in the neck). After it is read aloud, the students generate as many hypotheses as possible relating to the major complaint. These ideas are written on the board by the scribe. This activity lasts about five to ten minutes (and appears fun), after which the students call for page two.

Page two is initially given only to the "patient" until the "patient-doctor" simulation is over; then it is distributed to everyone. Typically, the "doctor" exhausts his investigation and, before everyone gets the page, each student has the opportunity to ask questions. When they have no more questions, page two is distributed and read aloud. This is followed by a group critique of the simulation to cover any missed ground, and to provide feedback to the simulated doctor and patient. Page two typically takes about ten to thirty minutes of the session.

Page three, the physical exam information, is distributed to everyone at once and read aloud. It contains information about the examination performed by the doctor on the case and usually contains unfamiliar medical tests, terminology, and chemistry values. Page four and the following pages begin the cyclic process of evaluating and revising hypotheses, identifying learning issues, and determining the next step.

Student Assessment

Students assessment is both formal and informal. The informal assessment is the ongoing self, peer, and facilitator feedback done throughout the year. The formal assessment is a plethora of tools arranged differently for PBLP-I and PBLP-II students. The information on assessment in the PBLP program is summarized from *The Facilitator's Guide* (Curry, 1991b), and a memorandum on grading procedures for 1993-1994.

PBLP-I students are assessed throughout the year in several formats: (a) four content examinations, (b) a one-to-one facilitator assessment of student performance (FASP) which is not factored into final grade but must be satisfactory, (c) two individual process assessments (IPA), (d) a subject examination (United States Medical Licensing

Examination, USMLE), and e) an evaluation of students physical examination skills.

The PBLP-II students have the same system; but instead of a physical exam, they are given an ambulatory care exam consisting of three parts: (a) preclerkship, (b) geriatrics, and (c) pediatric genetics teaching clinic. Many of these student assessment tools have been revised since the last publishing of the program documents. The following is a brief description the student assessment tools described in the literature.

The content examination uses broad multiple-choice, short answer/essay, and interpretation questions. The content exam requires about three hours and is completed at the middle and end of each quarter. The questions are generated by case writing teams and selected from a data bank of questions. The content exam is designed to acquaint students with Board-type questions and is used to identify strengths and weaknesses, as well as to contribute to overall student evaluation (Curry, 1991b, p. 22).

The Facilitator Assessment of Student Performance provides students with feedback on 24 performance areas. Each area is judged as either satisfactory, not observed, or needs improvement. The assessment form is a checklist with a request for a write-up on student strengths and weaknesses.

Individual Process Assessments are an individualized version of the small group case activity. Students are given a case and one hour to summarize the facts, generate hypotheses with justification, identify tests needed, select learning issues, and explain their rationale. This is followed by selecting one of the learning issues and having two days to prepare a research report describing the learning issues as it applies to the basic science aspects of the patient's problem. The report is graded equally in five areas: (a) information obtained from history, (b) information obtained from physical exam, (c) hypothesis and problem synthesis, (d) leaning issues, and (e) overall paper.

The United States Medical Licensing Examination (USMLE) contains seven individual subject exams: anatomy, biochemistry, physiology, behavioral science, pharmacology, microbiology, and pathology. Combined scores are reduced to a five-point scale and factored into the final grade. The USMLE prepares students for the National Medical Examination Boards taken at the end of the academic year.

Internal and external grades are given. Internal grades are derived for the purpose of determining outstanding, satisfactory, and unsatisfactory performance. They are also used to assign "Honors" (approximately 10% of class) and "Letter of Commendation" (approximately 10% of class), which

is done by reducing all instruments to a five-point scale with 5 as outstanding, 4 above average, 3 average, 2 below average, and 1 unsatisfactory.

Weighted means are produced from this scale with means of 1.50 or better equal to an "S". Below a 1.50 requires a review by the PBLP Student Review Committee and subsequent recommendation. Finally, external grades, used on transcripts, include three designations: "P" for progress (move to next quarter), "S" for satisfactory (pass PBLP-I) and "U" for unsatisfactory (failed PBLP-I) (Curry, 1991b, pp.23-24).

Setting Description (Physical Spaces)

The PBLP physical spaces are all in the same building. The three main spaces are: (a) administrative suite, (b) group meeting rooms, and (c) student study area which also serves as a common meeting place, and a PBLP reference library. A brief description of each is rendered.

Administrative Suite

The administrative suite is modern and well equipped, with computers for both secretary and director, a fax machine, personal copier, and small kitchenette. Two empty desks for students or visitors and three or four spare

chairs also sit around the office area. In the main common space office are two secretary stations, one for the PBLP secretary and one for Individual Studies Program (ISP) secretary.

A schedule of the cases for both groups adorn one wall with a checklist of things to accomplish for each case. A Cabinet filled with neat piles of course materials and a mailbox for each student stands against one wall. Typical of offices everywhere is the ever present in/out basket for each secretary.

The outer office has an open and homey feeling, as homey as possible with hard surfaces, desks, computers, fluorescent lamps, and file cabinets. The far wall has a fifth-floor view of other campus buildings through large windows across the room. The window sills are filled with plants, and a large Persian rug covers the floor. Left from the entrance is the PBLP director's roomy office, and to the right is the ISP director's office. As offices go, the PBLP administrative suite is well kept, orderly, and comfortable. It is a busy place with an obvious open door policy.

Group Meeting Rooms

All group session meetings take place in four specially designed classrooms (Figure 2). Each room is about 30 feet long by only 12 feet wide, producing a hallway feel. The

floors are covered with new grey industrial carpet. Three of the walls are cinder block covered with fresh beige paint; the inside long wall is formed by a large ceiling-to-floor grey folding room divider. The drop ceiling has three noisy florescent lights.

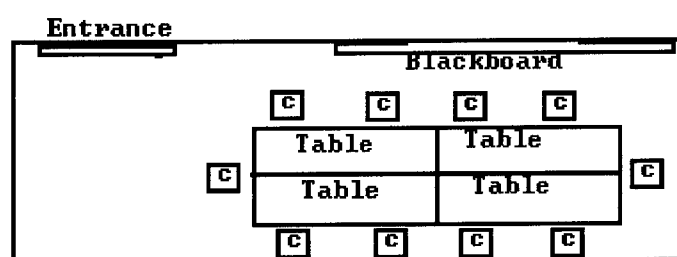


Figure 2
PBLP Classroom Configuration Diagram

The room furnishings are new but modest. They contain four cafeteria-type tables pushed together to form one large conference table surrounded by ten black, cloth covered metal chairs. On the longest wall is a ten foot blackboard; on one of the short walls is an x-ray viewer that didn't hold x-rays very well. Since the tables only take up 16 of the 30 foot room, one end of the room remained barren and unused, except for a coat rack and a few extra chairs for visitors. The width of the room, however, is barely enough for someone to squeeze by.

The room divider wall opens to adjoining session rooms. There are four session meeting rooms that open to each other to form a number of configurations. The environment is school-like, with all hard surfaces, large dusty chalk board, and round black school clock with the large numerals and jumping second hand.

The room is appropriately equipped for the group's work, with plenty of table top-space and good positioning for everyone to see everyone else. It was a bit awkward for the students whose backs were to the board, but those students simply turned around. In all, the room served as a fine private place for the group to work and learn.

Student Areas

Finally is the student resource, study, and meeting area. This area contains shelves stocked with references specifically for use by the PBLP and ISP students. Ten meeting or study tables and a desk with chairs are scattered throughout common space entry room. The desk is for a student receptionist who answers the phone and keeps watch over the library. The centerpiece of this outer area is a classic worn-out couch that, once sat in, is very hard to get out of.

Walking around the area revealed individual study cubicles for each student. Unlike the PBLP office and

classrooms, this area is shabbily painted and looks worn down with its brown cloth-covered dividers and scuffed, tiled floor. Generally though, the students seemed content here and put up posters of bones, various bodily systems, and other placards of the trade. It's a place to hang their hats.

Participant Introductions

The main players in the study include the six PBLP-I students in my study group, two PBLP-I students from another group, and two facilitators. A general introduction is followed by a character sketch of the six students in my group. The other two students and tutors are presented through a shorter summary since they did not participate in any demographic interviews.

Introduction to Students

Talented is the word that comes to mind to describe the students. While they are not unique to medical college entrants in general, they do rank within the top 10% of all students in the country according the OSU medical college entrance requirements. The sample group students are between 24 and 30 years old. One is engaged to be married, and one is married. None have children. All are Caucasian

American citizens except one, who is a second generation American Taiwanese.

The students are presented in no particular order with fictitious names to mask their identity. When asked, two gave names they wanted, and the rest cleared with the students later. Only first names are used except for Twyla, who requested she be called Twyla French.

The sample group consisted of four female and two male students. To get to know them, our first interview together was about their life: where they grew up, family make up, early school and undergraduate experiences, why medical school, and why PBL. An interview guide solicited the same information from each of them. They are, therefore, all organized in the same basic pattern.

The students not in the sample group are both male Caucasians. They are 28 and 34 years old, and both are married with two young children. One kept a journal and the other participated in a student interview during my pilot study.

Melody (Mel)

Mel is a 24 year old Ohio native. The oldest of five children, she has two sisters followed by two brothers. Her father is an attorney and her mother is a nurse who stayed at home since she was born. Mel is outgoing and fun loving.

She says she "make[s] the best audience in the world ... [she] laugh[s] at anything." Mel is best known for her stories because she seems to have at least one for every case.

When asked how she did in school she said,

I went to a Catholic grade school, first through eighth grade. Me and two twins, Kevin and Keith, were always the smartest kids in the class so we were always competing. I always did really well in school. I never found school to be a problem. In high school too, I graduated at the top of my class. Kevin ended up being one of the salutatorians, I was the valedictorian of our class (Mel interview, p. 1).

Her favorite class in high school was an advanced placement English class with "this amazing nun" who read and commented on every paper. Mel's efforts to participate in sports were ruined by sicknesses like strep throat. But, she says, "I did a lot of other things like student council and yearbook" (Mel interview, p. 1).

Mel went right off to Georgetown University after high school and declared premed/biology as her major. Among her college highlights she lists a memorable organic chemistry class, training as an emergency medical technician (EMT), and volunteer for Georgetown's school ambulance service. Her capstone experience, the year after undergraduate, was a year in Nicaragua as part of Georgetown's Jesuit International Volunteer Corps. This, she said, gave her a "much different perspective of the world. It was one of

those things again that I knew I wanted to do" (Mel interview, p. 4).

When asked if she'd dealt with medicine there, she said,

Yea, almost to be a doctor down there is to be too qualified. We did a lot of immunization, just a lot of giving out parasite medicines. One of the biggest problems on the island was lice. Kids would get lice, then they'd scratch, then they have bacteria and funguses in their nails and they affect their head so it was things we don't have here. Worms, malnutrition, that kind of stuff. This is what I want to do. I knew I wanted to be a doctor for so many reasons (Mel interview, p. 3).

The combination of her mother being a nurse, her interest in her own illnesses, her EMT/ambulance work, and the Nicaragua trip all pointed her toward medicine. The clincher though was a number significant emotional events in her life. Over a period of eight years, since she was a freshman in high school, six of her friends died in either freak accidents or of some unknown cause. She said, "This is another reason why I went into medicine. I think for someone my age I've had a lot of experience with death" (Mel interview, p. 3).

Reacting to her story, I summarized that that was six people. She replied,

Oh yea, I've had tons, both grandmothers died and then I had a grandfather plus all my friends, and a lady while I was on ambulance duty. The thing is, it's made me think a lot. I wonder why we are here and what you can do and how death is a continuation of life somehow. I remember thinking that life is very short, when this happened to Rob and I remember thinking that I never want to be

unhappy doing what I'm doing. Seriously, if I am, I don't want to do it (Mel interview, p. 3).

Mel chose PBL because she felt her experiences set her up for it. She was introduced to the PBLP when she interviewed at OSU:

It just struck me, this is what I want to do. It seemed like a great way to learn, it's holistic, it's case based, it gives you freedom to plan your own schedule, I couldn't think of a better way to do medical school (Mel interview, p. 4).

Her many experiences and outgoing nature got her a reputation that became a running group joke. Whenever a new disease would come up Mel either had it herself or knew someone who had. Being an outgoing person, she was considered by some as one of the informal leaders of the group.

Evidence for this came from Kirk, a fellow student. He was conducting a personal experiment in leadership by not leading and noticed, "As our time progressed, I began to watch Mel emerge as a new leader" (Kirk journal, p. 1). In her interview, however, she said, "I do feel you need a direction or a focus but I don't have a big problem with somebody not being a leader" (Mel interview, p. 5).

Kirk

Kirk is 26 and is from Middletown, Ohio. He is the oldest of four sons. Kirk's mom and dad are both teachers. His dad is working on a Master's degree and teaches high school math, geology, and earth science. Mom has her

Master's and teaches seventh and eighth grades. Kirk is the only married student in the sample group, and he takes his schooling very seriously; but he also has a good sense of humor. He is best known for his questions, which he asks incessantly. This usually puts him in a position of group leadership which can be both good and bad. Sometimes his questions would lead the group well, sometimes they would cause frustration.

He says of high school, "I did really well in high school, I mean academically. High school was not very challenging if you go to a public school at least in those public schools" (Kirk interview, p. 1). Kirk played soccer most of high school and tried cross country and football, but didn't care for them.

Kirk's undergraduate degree is from Harvard and he says he went there on a dare:

Some girl in my high school who was actually making fun of me. She said, "Oh wow, you did so well at school you think you're going to go to Harvard?" and I said, "Oh, maybe I will?" So, I got in (Kirk interview, p. 2).

"There is no major called premed [at Harvard]" he said.

"You just have to have certain courses so I made sure I took those as I went along" (Kirk interview, p. 2). He graduated with a 2.3 GPA, Cum Laude, which he described as above average for Harvard. His degree is in biology.

Kirk became seriously interested in medicine in his senior year in high school for several reasons. First, he says,

[M]om and dad were both interested in science and so all growing up, everything I can remember, every family trip, 'notice the geology on the left ... notice the things on the right' and things like that so I was interested in science already. (Kirk interview, p. 1).

Another thing that attracted him was the challenge:

Just knowing that it would be a challenging career and I guess at the time it was sort of looking to doctors as being like a pinnacle in the education process. Between that and just being interested in the human process (Kirk interview, p. 1).

Before applying to medical school Kirk took two years off to teach high school biology and get established. During that time he saw a documentary on TV about problem-based learning and he knew that was what he wanted to do. He declared, "I had already started thinking about programs in my application process where I cut out a lot of schools that have only your traditional learning style" (Kirk interview, p. 3). Between in-state tuition and PBLP, the choice was easy.

Kirk was one of the students who volunteered to keep a personal journal for my research, but he didn't start until the middle of the quarter. Nonetheless, his logged reflections and answers to my direct questions provided valuable data and are most appreciated. In a reflective

statement concerning his felt responsibility to the group he said,

My responsibility to the group is an aspect of my character I'd really like to improve. Though I do not compete against the others openly, or even consciously most of the time, it is in my nature to be a competitive man. I want to be not only the best student I can be, but also the best student (at times). I balance this with the knowledge that PBL is a team process in part, just as the field of medicine. In this sense, PBL does much more than LD could ever hope (Kirk journal, p. 7).

Twyla French (Twyla)

Twyla is a 25 year old who grew up in Idaho. She is the oldest of two children and has a younger brother. Her dad is a family physician, and her mom is a nurse but has worked at homemaking since she was born. Twyla had a reputation for being smart and somewhat moody, shifting from bright, cheerful, and participative, to quiet and somber. In the interview she revealed a family situation which helped make sense of this pattern.

Her answer to "Did you do well in high school?" was, "Yea, a perfect GPA. Perfect behavior except in band." She said, "I guess high school was uneventful. I was involved in a lot of stuff. I was completely compliant" (Twyla interview, p. 2). However, later in the interview she revealed that she participated in a lot of college classes while in high school and was considered a "math whiz" as a

kid. She said, "Yea, it's in my blood--the logic thing" (Twyla interview, p. 3).

Twyla attended Wellsley College on her mother's recommendation and graduated with honors (3.76 GPA). Some of the highlights of her time at Wellsley include spending her junior year in France (she's bi-lingual), a summer working in Newport, R.I., a summer in Colorado working with Llama's, and a summer working in a hospital in Cambridge, MA, where she received training as a nurse's aid. "That's when I really decided that I would like to become a doctor" (Twyla interview, p. 3). That interest had started earlier, sometime between high school and college. She explains,

Sometime between high school and college I realized that the premed requirement was just four years of science and I was interested in the sciences so I just declared myself premed ... I liked science, so to me it seemed like practicing medicine was the thing to do (Twyla interview, p. 2).

During those college years, though, Twyla said she suffered from clinical depression. After graduation she spent a year at the Fuller Theological Seminary as a French and modern anthropology major. While there, she discovered through long, late discussions with her psychology major roommate that the depression she was experiencing related to her family situation. That marked a turning point in her life, and the next year she applied to twelve medical schools.

Twyla learned about the PBLP program when she came to OSU for an interview:

[I] thought it was a good approach to medicine to more likely be able to deal with the whole person as a whole person as apposed to something that was really segmented. Like the segmented learning approach seemed to me that it had led into a segmented approach to the patient (Twyla interview, p. 5).

She also said OSU was "great in my interviewing process" (Twyla interview, p. 4). She cited quick response, good information, and personability as the traits that lured her.

Twyla was known for her manner of speech (Valley Girl), and speaking her mind when she had a complaint. Kirk shared in a journal entry that he learned several things from Twyla: "If you have complaints, make them heard; grumbling is a terrible habit. I also got a lesson in learning how to listen to a person whose speech patterns are different from mine and how that affects my view of them" (Kirk journal, p. 6). In a group interview she summed things up about herself when she said, "Well, actually, I like PBL a lot, and I like our group a lot, but there are so many ways people can push my buttons at this point in my life that it's not even other people" (Group interview, p. 3).

Martha

Martha is 24 and grew up in Sylvania, Ohio, a suburb of Toledo. She is the forth of five children spread over

thirteen years. She has an older sister, two older brothers, and a younger sister. Her dad works in finances and her mom is a full time homemaker. Martha is focused, hard working, and conscientious. She has great drive and determination but is often frustrated because she is so hard on herself.

Martha has always been a good student and relates her high school experience like this:

There were times that I hated high school and other times that I liked high school. I always did well, I mean, ... I stressed myself a lot I think. The school I was in, it was very competitive, especially in the honors classes. There were only twenty in my class, we had a small class and I graduated with a 4.0. Gymnastics was the biggest thing in my life and I didn't have time for a social life at all and I wasn't involved in any other extra curricular activities (Martha interview, p. 1).

She had gymnastics meets from October through May. She says of those meets,

[Y]ou have all these little idiosyncrasies and superstitions and you have to eat at a certain place so many hours before the meet and you have to do everything exactly the same for each meet or else that will mess you up (Martha interview, p. 1).

This continued into college.

Martha graduated as a biochemistry major from the University of Iowa with a 3.89 GPA. Most of her memories are of gymnastics, however, not scholastics. She reports she can't really remember how she became involved in

gymnastics or where her initial interest in medicine came from:

I know I've always been interested in health and nutrition and exercise ... how the body works and always fascinated with science, it's been one of my favorite subjects. So I guess it's kind of a mixture of that and liking to help people or wanting to help people. (Martha interview, p. 1).

Originally she thought about being a veterinarian, but after she worked for a vet she changed her mind because of the way she saw that people treated their animals. "I nixed the vet thing and I thought, 'What's next?' and I thought doctor ... it seemed like a natural fit. I did like anatomy in high school" (Martha interview, p. 2). She made that decision her senior year in high school.

Martha learned about PBL when she came to OSU for her interview. At first she was uninterested. But later, after reading some PBLP program literature, she called Dr. Curry to get more information. He suggested that she sign up if at all interested because she could always take her name off the list. The list was first-come and first-served and it was about full. "So I just signed up," she said, "and never took my name off the list" (Martha interview, p. 3). She liked the idea of flexibility and thought it would allow her to work out when she wanted.

Martha was known in the group for putting stress on herself and even she testified that as evidenced by a quote from our interview:

QUESTION: You know a lot about yourself as far as the stress in your life. Do you do something to get rid of that or is that what makes you go?

Martha: It's a balance. . . . I think gymnastics was always really good for me in terms of the balance between school and gymnastics because I could put pressure on myself in school, then go and work out for three and a half hours and have a different kind of pressure, a very liberating type of pressure. Then I could go back to studying no problem. I was always fresh and ready to go and very efficient in my mind especially.

But now I don't have that mind clearing. I mean, I still work out but it's not the same. In gymnastics there was always a goal and a striving to have a sense of accomplishment or achievement. . . . Now you don't have that so much and it's all just school, school, school. What's the plan, I don't know. I bought these two books and hopefully they'll help me (Martha interview, p. 2).

Scott

Scott is a 23 year old first generation Taiwanese American. His parents are originally from China but moved to Taiwan and then America before he was born. He grew up in Madison, WI and Chicago, IL where his dad went to school and taught. Scott is the oldest of three children, with a brother and a sister. His dad is a physics research scientist and his mom a homemaker. He says his parents hold high expectations for the family, and that he is the culture breaker for his younger siblings, which "was a lot of fun. My brother and sister have it easy," he says (Scott interview, p. 1).

Scott is another of my journal writers and is considered the quiet one of the group. He is well respected though, because when he speaks he makes valuable contributions.

Gwin commented in a journal entry:

Often there is a person in the group who is generally a good listener and on the quiet side, but who is able, when needed, to pull ideas together and to point out the important points and comments made by another person (who went unnoticed) to the rest of the group. I think [Scott] might be a little bit that way (Gwin journal, p. 4)

And again, later that week:

Today [Scott] demonstrated the kind of leadership I wrote about earlier this week. He wasn't showcasing his own knowledge but instead guiding the group and recording members' output. I wish he'd be this participatory more often because he is obviously very intelligent, well prepared, and capable of piecing together basic concepts (Gwin journal, p. 4).

Scott went to an alternative high school where entry was determined by lottery. The school had no sports but he did participate in the performing arts: two musicals and a national competition in performing arts held in New Orleans his junior year. In addition, he is bi-lingual (English and Chinese) and is an accomplished pianist. He says high school was fun, graduating third in his class with a 3.92 GPA. Scott took enough advanced placement courses in high school to enter college with one semester already completed.

Scott attended the University of Michigan and majored in cellular molecular biology specializing in DNA and molecular genetics. He graduated with honors maintaining a 3.75 GPA. He did not decide on medical school until the summer between his sophomore and junior years in college.

As he explains it:

Up until the end of my sophomore year I thought I was just going to go to graduate school, get a Ph.D., do research, and teach. I've never really been exposed to medicine. There is no member of my family whose even affiliated with medicine. It was only until then when I had friends who were premed and they were talking about medical school. I always pictured medical school as this huge monolithic deal that I would have to leap over and for some reason I just quickly passed it out of my mind.

But then I got to thinking about that and thought that would actually be a really neat challenge, also, I had always been fascinated, and I guess all the biology courses I'd been taking just got me more and more interested, in the human body. That, coupled with the fact that the challenge kind of appealed to me and the profession, after I thought about the profession, it's an ideal profession, there's perfect job security, the money's fine, if you want to do research you can always do research. So I thought, "sure, why not." So during that summer between my sophomore and junior year I just decided to go to med school (Scott interview, p. 3).

Scott had been exposed to PBL in his junior year through his friendship with Dr. Curry's son. He happened to mention he was thinking about med school when he was at their house one day and the rest, as they say, is history. He visited some other schools, and decided "I'll just go to PBL and have fun in the process" (Scott interview, p. 4).

Even though Scott's group participation increased near the end of the quarter, he is still known as the quiet one.

As Kirk wrote in his journal:

Sometimes a single comment or action can follow you for a long time. [Scott] will always be seen as 'the quiet one,' though he now participates almost as much as everyone. 'You never get a second chance to make a first impression'" (Kirk journal, p. 6).

Gwinivere (Gwin)

Gwin is 24 and hails from Dayton, Ohio. "From second grade on I lived in Oakwood which is a very sheltered community. It's pretty affluent and completely Caucasian and not very diverse in a lot of ways" (Gwin interview, p. 1). She is the older of two girls. Gwin's dad is a practicing private psychologist and psychology professor; her mom is a full-time homemaker.

Gwin is insightful, caring, reserved, and cautious when speaking--cautious in a way that is sensitive to the feelings of others. She is one of my journal writing students and is known for being the person to bring up the behavior science issues. Kirk said of her in his journal, "A very insightful woman whom I respect a great deal" (Kirk journal, p. 6).

When I asked if she was always a good student she said, "Yea, [in] high school I was valedictorian and in college I

was a Phi Beta Kappa so I always carried a high GPA I guess" (Gwin interview, p. 2). Gwin says of herself "My reputation as a student in the past has always been the quiet achiever" (Gwin interview, p. 1). She credits that to hard work and a puritan work ethic, not necessarily raw intelligence.

From second grade through high school she stayed with the same group of 120 students. While she was in high school she said she had several experiences that impacted her life: two family member illnesses, and an honors group who went to medical and other science seminars. In addition, she spent a summer as a volunteer in a hospital sleep lab.

"Basically," she said, "I just tucked people into bed and explained tests to them. It was really fun" (Gwin interview, p. 1).

Gwin went on to major in religion at the College of William and Mary. She said,

I can't isolate a time when I decided I wanted to be a doctor because ever since my parents or anyone ever asked me that question I said I wanted to be a doctor. I'm not sure where that came from because there aren't any physicians in my family.
(Gwin interview, p. 1)

When asked why she wasn't premed, she said, "I figured I'm going to get all the science I need in medical school, why not do something else now? I knew I was going to go to medical school. There was never a question, never" (Gwin interview, p. 2).

At William and Mary she had a positive experience with a "super teacher who kind of took the PBL approach" (Gwin journal, p. 1). She mentioned that this professor was the "most challenging professor who pushed her to participate in discussion" (Gwin journal, p. 2). So, she said,

When it came down to choosing it came down to financial and a lot of it was PBL. I hadn't really thought about it until I came here and saw it and thought, boy, that would be fun. It seemed a lot more like my religion classes that I really enjoyed and none of the other schools had anything like it. I remember that I went to the University of Chicago to listen to a lecture and it was so boring that I thought I don't want to do this for two years (Gwin interview, p. 2).

Eventually she says she would like to give back to the PBLP by being a facilitator. Her vision, though, is to use this forum to bring MD and nursing students together to strengthen the medical team.

Will and Jim

Will and Jim were two other students who generated data for my research. Will participated as my first student interview and Jim kept a journal over the entire ten weeks. Their contributions added more volume and another source of data to the study.

Will is a 30 year old married student with two children. He heard about the PBLP through a two friends who had experienced it and liked it. At the time he was working on

a Ph.D. in nutrition and decided to check into the PBLP program. He says, "Dr. Curry was very enthusiastic and very positive about it ... that's what kind of made my mind up for me" (Will interview, p. 2-3). He says he's in the program because he went with his "gut feeling that you learn more when you actively participate" (Will interview, p. 3).

Jim is thirty-four, married, with two children. Jim comes to the PBLP with many life experiences as a teacher, emergency medical technician, opera singer, and fireman. He was the most faithful journal writer both in keeping up and in depth of reflection. Coming from a background that included performing arts gives Jim sensitivity to the group processes and group members. He says of his PBLP experience, "We are learning, by sharing our own painful and happy experiences, that the patient is a person just like us" (Jim journal, p. 5).

Facilitators

Two facilitators were assigned to the sample group. One was Dr. Curry, the program director, and the other was Dr. Newcomer, an immunologist. Both were present through nearly every session; Dr. Curry missed three, Dr. Newcomer missed two, and neither attended one session. Dr. Curry is a veteran facilitator, performing in that capacity for most of the quarters the program has been in existence. Dr.

Newcomer on the other hand was a "newcomer", this quarter being his first introduction to the PBLP.

Chapter Summary and Closure

Patton (1990) says, "The purpose of the description is to take the reader into the setting" (p. 31) by including "a great deal of pure description of people, activities, interactions, and settings ... [and] direct quotations from people, both what they speak and what they write down" (p. 32). This chapter described the PBLP program and the research participants. These descriptions were developed through interview, observation, and document analysis. Following the advise of Glesne and Peshkin (1992) to "strive for accuracy" (p. 47), the chapter portrayed the settings, workings, and participants non-judgmentally, yet with enough information to allow visualization by the reader (Patton, 1990, p. 217).

In addition to the qualitative methodology authors, these descriptions are called for in the PBL literature. By giving the definition, history, administration, case development, roles, group make-up, group session process, assessment, setting descriptions, and participant introductions, the research context is fully described to aid the reader in understanding the whole as an array of complex systems.

This chapter provides the kind of details useful for comparing programs across different schools, historically date-stamping an evolving program for later analysis and reflection, and describing the uniqueness of the participants in this setting. The chapter also provides the foundation for understanding the analysis of data that follows. These physical ("what") and social ("who" and "how") aspects of the PBLP program frame the observations and give them power to inform and aid in understanding the phenomenon of this Problem-based Learning Pathway.

CHAPTER V

ANALYSIS AND INTERPRETATION OF DATA

The purpose of analysis is to organize the description so that it is manageable. Description is balanced by analysis and leads into interpretation (Patton, 1990, p. 430).

Introduction

This chapter answers the questions: What are the important design characteristics of the PBLP curriculum? and (b) What are the key elements of experience for students in the PBLP? The literature review, methodology, and description of the program and participants provide the context for understanding this chapter. The last chapter discusses ways to use these findings.

This study was done by joining a PBLP group and experiencing their session life through observation and participation over a ten week period. Continuous observation notes were taken about what was observed, felt, and sensed in all the sessions. In addition, seven sessions were videotaped to capture an accurate portrayal of PBLP session activity.

Outside of session students were interviewed and asked about their insights of the PBLP. The students were also asked to comment on the session observations shared with

them, and five students kept a daily journal chronicling their observations and feelings of the sessions and the PBLP in general. Last, data were collected from the PBLP director interview and PBLP program documents.

Through the activities and documents mentioned above, a reservoir of data were collected about the OSU PBLP program and what it is like to be a participant therein. This chapter reports the analysis and interpretation of that data from both my and the students' perspective. Analysis and interpretation are interwoven to present the findings and to describe what they mean.

Analysis breaks the whole into parts for study to determine the nature and proportions of what is being researched. Interpretation explains the parts' meanings and presents them in understandable terms. Understanding comes through both analysis and interpretation; one without the other is insufficient. Eisner (1991) says,

There is a difference between description of behavior and its interpretation ... "straight" description ... is almost never adequate without interpretation. . . . To interpret is to place in context, to explain, to unwrap, to explicate (p. 97).

The report is rendered using a mix of analytic and interpretive descriptions along with examples and quotes. The examples and quotes are excerpts from the observation and code files. They serve to capture what Patton (1990) calls "the 'emic perspective'--the insider's perspective on

reality" (p.241). Referencing of quoted data is for researcher identification only.

Although the report is rendered using direct quotes, it must be understood that these interpretations are from my point of view, shaped by my ontology, and rendered in the order I used to make sense of them. Bogdan and Biklen (1992) say "[i]n writing up qualitative research you present your point of view, your analysis, your explanation, and your rendering of what the data reveal" (p. 193).

The findings are presented in four ways. First is a description of nine PBLP entities unearthed by the research. Next is a typical group session given in story/narrator format. Four patterns observed in the group session process are then described before the last section, which explores six specific codes associated with group work critical to the PBLP process. The chapter ends with a summary and conclusion to review and pull the findings together.

Entities of the PBLP

Following an analysis of all data, nine entities are evident, each with a life of its own, complete with birth, function, and expiration, metaphorically speaking. The "lives" include assessment, resource, group, individual, session, case, page, question, and learning issue. Each "life" fits hierarchically within the previous "life" as

they play their parts in the PBLP model (Figure 3). Every higher level life is dependent upon the life or lives it rests within, with the exception of assessment and resource, which live in conjunction with all of them.

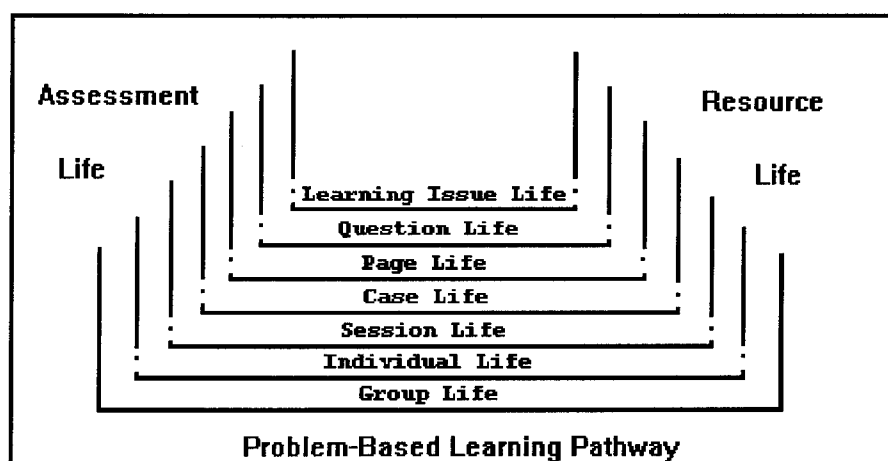


Figure 3
PBL Lives Model Diagram

In this model none of the "lives" are independent but the substance of each flows through all others. Deconstructing the PBLP in this way helps describe the PBLP. But like any life or lives, the complexities of its entities are endlessly interwoven.

Next is a fuller description of each "life" and how it comes to exist, function, and expire. The interpretation starts with "Assessment Life" and "Resources Life," then continues from "Group Life" through "Learning Issue Life."

This strategy of revelation displays the dependency and support functions of the PBL "lives" among each other.

Assessment and Resources are two PBLP "lives" that permeate all the others. They are mentioned because of their obvious "lives" within the program. An awareness of them before the other "lives" serves to highlight their all-pervasive nature.

Assessment Life

"Assessment Life" refers to the process and product evaluation of all the PBL lives and the PBLP program. Each PBL "life" that follows is formally assessed by program assessment tools, and informally by PBL participants. Observation and/or participation of assessments did not occur, so their descriptions are beyond the scope of this study. Assessments are an ever present and integral part of the PBL Lives Model.

Resources Life

"Resource Life" also permeates every entity of the PBLP Lives Model and functions to provide information to satisfy the needs of the other "lives." While independent study was not observed or participated in, resources were obviously the key to that activity. Also, throughout each session

every student in the group had at least one resource book opened, and sometimes as many as four.

Evidence for the importance of resources came vicariously through observing learning issue discussions, show and tell, and personal resources brought to session. The example below was played out hundreds of times with slight variations.

Case 121 Session 2 Page 1 observe

Martha: What book is that?

Kirk: I wish I had this from the beginning.

Martha: How much?

Kirk: \$20 or \$30.

Gwin: My biochem used it because all my notes are exactly ...

Mel: It's a great book.

[Expanded observer comment: This is a valuable part of what happens when they go off to study. This book they are referring to offers a wonderful breakdown of steroid metabolism.]

Resources ranked fifth in frequency of code occurrence, the greatest portion having to with finding them, quality, cost, currency, and usefulness. In every session students shared what they found that was good, bad, or not helpful. The identification and use of resources and the way resources play into the PBLP was an extremely important aspect of the program.

Group Life

"Group Life" comprises individuals working together in sessions, with cases (revealed through pages), producing questions, leading to learning issues. It begins at the

start of each academic quarter when the director assigns individuals to groups and ends with the quarter. "Group Life" exists as a fabricated social unit constructed for the purpose of facilitating the problem-based learning process in which individuals and the school reach their goals.

"Group Life" is the foundational entity of the PBLP. As such, it entails all aspects of group dynamics which encompass membership, norms, pressures, perceptions, communication, goals, leadership, and work. All of the subsequent "lives" are discovered observing and participating in group life. Groups are formed by six students who are homogeneous to medical school but unique as individuals.

Individual Life

Individuals are born into the program upon acceptance to OSU's PBLP program and, in this model, expire upon graduation. Individuals function independently and in groups to make the program work. Each participant brings to the program all of his or her indiosyncracies and special talents, experiences, and energy, commonly referred to as personalogical variables.

Personal roles consist of balancing a complex array of social demands, group demands, and personal needs and desires, in a way that moves the participant toward his or

her goals. To realize those goals the student must learn to direct his or her own learning and work with others who are struggling to do the same. The roles are played out in small groups, which form the foundation of the PBLP program.

Individuals in the study were not observed outside of the group. Therefore, the term "Individual Life" operationally refers to student lives lived within the group. The individuals were representative of all the first year medical students at OSU. Individually though, each student's specific experiences, knowledge, attitudes, approaches to learning, appearance, family make up, and interests were different. Of all the entities, the individual was the only one totally uncontrived and therefore the least controllable. The term for individuals meeting in group in the PBLP is called a session and it takes on a life of its own.

Session Life

"Session Life" is a term contrived to encompass all that goes on with a group session meeting. A session is a group of individuals meeting together at pre-arranged time and place for three hours, three times a week. All the observations took place in session.

"Session Life" serve as a forum where the group and its members play out their roles. As such, each session had its

own tone, timing, temper, and trials. While similar in setting and time, every session started in a different way, proceeds with its own agenda, and ends with its unique history. Observations, however, revealed session six segments not part of the official program agenda: (a) social chatter, (b) front matter, (c) group work, (d) LI identification, (e) wrap-up, and (f) back matter.

All twenty-eight sessions started with greetings and "social chatter" about schedules, food, personal stories, good books (medical texts), and TV shows. Usually in the first ten or fifteen minutes of the session, the social chatter was transitioned with a word or comment toward front matter, the next segment. For example:

Case 121 Session 1 Page 1 observe

[Observer comment: Boy, the mood is light. Everyone is talking about food and cooking in regard to fat and their recent study of lipids. There is some excitement about a sugar called left hand sugar that is fat free because your body can't absorb it. Not unlike any other academic endeavor these students bring with them news of the outside world.]

Kirk: Anyone have any question from yesterday?
[transition]

Case 131 Session 2 Page 1 observe

[Observer comment: Mel starts by sharing about a patient she saw at her preceptorship diagnosed as shingles and how it was cool that she was because she'd just studied infections and came across it. This is a good example of how students use their experiences within the curriculum which makes their experiences the curriculum.]

Mel: Do you know what heterophile is? [transition]

[Observer comment: This question begins the session by focusing the group toward one of the LIs from the previous session.]

Front matter consists of talk about the independent study of LIs from the previous session. It could involve anything from finding a good resource to a personal experience that relates to the case. An good example of front matter was seen in day four on the AIDS case:

Case 136 Session 4 Page 1 observe

Gwin: Did you think the LIs were good? Are we going to continue on the fungus crusade?

Kirk: I think we should do opportunistic infections. This book has them all grouped together.

Martha: Reads from her notes what should happen.

[Observer comment: Scott is searching his micro book while Mel is reading from a dictionary of medical terms.]

After the group played out its front matter they called for a new page and slipped into a segment of making progress on the case through group work. Most session time was consumed by group work consisting of discussions, questions, challenges, and clarifications. But about one-half hour before the end of the session, someone alerted the group it was time to pick learning issues. It took about fifteen minutes for the group, led by the scribe, to choose the LIs for the next session. These excerpts exemplify this transition:

Case 101 Session 1 Page 3 observe

Mel: What are you guys thinking about for learning issues?

Case 131 Session 1 Page 6 observe

[Observers comment: Twyla goes down the list and reads out the LI name trying to get a consensus. The first four become the LIs selected and the last three are saved for tomorrow.]

After the learning issues were chosen, the facilitator led the group in a feedback session for the remainder of session. Usually referred to as the wrap-up or debriefing, it was normally squeezed into the last few minutes of the session by a one line statement like, "Well, how'd we do today?" The program documents describe this segment as an effort to evaluate and improve group performance.

The data suggests that wrap-up, while an important aspect of the problem-based learning process, does not add much value to the process. For example, Mel said,

I was just sitting here thinking about it [debriefing] and I guess in any of the groups I've been in I've never known how other people felt about my participation in the group because they don't really tell each other that often. It seems like a really huge problem in the group and sometimes we try to talk about it, otherwise you go on a day to day basis and you think I don't know (feedback.doc, p. 2).

Other evidence comes from Kirk, who said, "I don't think that we do have enough feedback from different people in the group," and Twyla, who commented, "[i]n this group, for some reason, I haven't felt very comfortable getting a good debriefing time, I don't know why," and Scott, who stated, "[i]n reality I'm not sure how open people are and how receptive people may be to criticism" (feedback.doc, p. 2).

The wrap-up never seemed to work well. It may be due to a couple of common maladies having to do with its timing and circumstances. First, at this point in the session everyone

was ready to leave and in fact several must leave. Second, it seemed very awkward and artificial just to "turn off" the session and "turn on" critique and feedback. Like pre-planning a deep and meaningful conversation with another person, while the intentions are good, it just doesn't work well. Somehow, spontaneity works best.

When session was over a sort of reverse front matter happened--back matter, with some students rushing out, some sauntering out slowly, and some hanging around to talk with the facilitator or each other. More often than not, this latter time usually contained better feedback and session critiquing than the official wrap-up did.

In summary, sessions had a life of their own, divided into observable segments identified as social chatter, front matter, group work, LI identification, wrap-up, and back matter. Each segment was characterized by a certain focus which, since revealed, can be analyzed for its value to the PBLP. "Session Life" provided the arena for the next PBL life: "Case Life".

Case Life

Born of history, cases are the main part of a Problem-Based Learning Modules (PBLM) which contains all the case parts. Case Teams write PBLMs based on information extracted from medical records. The guide for writing cases

states, "[t]he PBLM should contain all relevant information about the patient, presented in a logical, progressive manner" (Curry 1991a, p. 15).

Once a case is written it lives out its life in group as a story, unfolding page by page. Cases are designed to present a real story in a way that works to peak a student's interest and gets them involved in more than scientific mechanisms.. Jim offers a student's perspective of the significance of the life of a case like this:

You can see the application of what we're learning and how we're going to use it later. For me personally, it just makes it a lot more exciting. For example, right now we have a case of a lady who comes in with a problem with her knee, an older lady. It looks like arthritis but we don't know for sure. We don't even know what the physiology or biochemistry of arthritis is, necessarily. But, we look at the medications and we talk about all the aspects of her care. The fact she's a widow and how that might impact her and how she's feeling, to the fact that she's had a hysterectomy and all these different things. So we're looking at the whole patient the first year rather than waiting till the third year (Jim interview, p. 2).

Every case underwent continuous formative evaluation and became part of a bank of cases unless found to contain outmoded information and/or procedures. Ten cases, each with a distinctive life of its own, were completed during the research (Table 13). Close observation reveals three

Table 12
PBLP Cases Used During the Study

<u>Case No.</u>	<u>Patient</u>	<u>Disease</u>	<u>No. Days</u>
143	Leslie Biggins	MS	3
108	Belinda Owens	Ectopic Pregnancy	2.5
129	Karl Andrews	Klinefelter's Syndrom	1.5
121	Baby Boy New	Abnormal Genitalia	2
131	Timothy Trew	Mononucleosis	2.5
169	Galen Linder	Hepatitis B	3.5
136	John Dugan	AIDS	4
110	Jimmy Kruger	Cystic Fibrosis	3.5
101	Bettinal Moore	Pulmonary Embolism	3.5
158	Elizabeth Stuart	Cervical Cancer	3

areas unique to case life. First is the pace a group moves through a case; second is the pace of the actual case when it was handled; and third is the order of placement or timing of a case within the quarter. Discussion follows for each of these areas in turn.

Observations relating to the speed of forward movement on the case is described as the pace. A comment from the first case illustrates the struggle to describe the pacing of a case.

Case 143 Session 1 Page 3 observe

[Observer comment: Pacing of the case is difficult to describe. Individuals want to press on, linger and ponder, dig deeper, or just move forward. (pace.doc, p. 2).]

There is evidence, however, that students generally felt rushed. The following excerpts point out this trend and highlight what one student thinks is the cause--lack of

understanding about what needs to be accomplished in session:

Case 136 **Session 3 Page 10 Jrnl Will**

Today's meeting seemed to move quickly.

Case 131 **Session 1 Page 6 observe**

Scott: What do you think about the speed of the case?

Twyla: It was appropriate for this case.

Newcomer: You just did 2 1/2 days.

Martha: How do you feel?

Scott: I feel it's a bit rushed.

Case 101 **Session 1 Page 4 observe**

Kirk: It seemed like we zipped over some things today that we didn't know about.

Case 143 **Session 2 Page 3 Grp interview**

Twyla: We really didn't have much guidance on how to pace ourselves other than what we could really accomplish. I think the expectation of what we need to accomplish during the session has been fluctuating throughout the year.

Lack of information about the pace of the actual patient encounter was sometimes a problem. Fidelity of a case broke down when the students could not determine when tests were done, how long they took, and other case information bits. Kirk illustrated this by saying, "[i]t looks like there's a break between pages 5 and 6. How did this actually play out, and when, if at all, would we have to tell him this?" (caseinfo.doc, p. 1). An expanding note on Kirk's statement provides some interpretation:

[t]his is another problem with a case I failed to identify previously--the pacing of what took place on the pages, i.e., how long for lab results, treatment to take affect, between visits, vital signs, and on and on (caseinfo.doc, p. 1).

Finally, the sequence of a when a case was used in the quarter was important. The director noticed in hind sight that certain cases would work better if they were included earlier or later in the year. The following excerpts exemplifies this:

Case 158 Session 2 Page 5 observe

Curry: What do you think about a page 10 with all those details?

Kirk: This has been a tough case because she keeps coming back with trouble.

Curry: I guess if I was going to do it again I'd put it earlier in the quarter so you have time for an enrichment session.

Case 136 Session 3 Page 4 observe

Mel: It's a really interesting case.

Scott: It's loaded.

Twyla: I liked it

Curry: I really struggled with putting it in this year but the second year [students] tried to do all microimmunology in the second year so this is the first year I've tried to do it. This is the first year I've tried to stay with a group for the whole year so I can get the sequence of cases in the right order, for instance, I would move the two blood cases back to this one.

In summary, each case carried the same basic format, at least through the first three pages, but beyond that they were thick and thin, long and short, easy and hard, visual and verbal, fast and slow. The speed of forward movement and unknown match of pace between the actual and PBLP case could be troublesome to the students. And finally, the PBLP director has found that cases can be optimally ordered. Isolating "case life" brought to light these three aspects which can be used to prepare strategies for future cases.

"Case Life" provided a home for "Page Life," the next "life" to describe.

Page Life

"Page Life" served to move the group forward on the case by presenting students with new information as they exhausted their questions and learning issues from the previous page. Work on a page covered several minutes or several days, depending upon the amount of new information it contained.

Page life was determined by the information, or lack thereof, presented on the page. For instance, many page two's, containing the results of initial interview, were lacking information students believed was needed, or at least thought would be helpful. Extracts to illustrate the lack of case information were found in nine of the ten cases covered and included:

Case 129 Session 1 Page 1 observe

[**Observer comment:** There is some humor because Mel asks if he ejaculates when he does have an erection - he doesn't know.]

Case 108 Session 2 Page 3 observe

[**Observers comment:** The case says "large" but the students are talking about how large "large" is. The facilitator says we'll have to back and find out.]

Case 129 Session 1 Page 2 observe

Kirk: I wish he had a better memory so we could ask him about years 18-29.

Mel: You would think that they would do a better job of the history.

[Observer comment: Other frustrations are noted in the interviewing process because they can't get at an earlier history of the patient's life.]

The page information, according to the program documents, is designed to contain relevant information for the case. Therefore, in a PBLP case page, what is relevant has already been determined. Realizing the relevance was in the page, students drew inferences that might not be evident in an practice. For instance:

Case 129 **Session 1 Page 2 observe**

Mel: The armspan must be important or they wouldn't have put it in there.

Case 110 **Session 1 Page 3 observe**

Martha: We can call for a lavage and if they didn't do it then we don't get it and then we'll know.

Case 169 **Session 6 Page 6 observe**

Martha: Is the next page a test or treatment?

Providing and lacking information was the essence of page life. Students realized that pages contained only relevant information and sometimes used that to their advantage. Understanding "page life," and that it revealed and concealed information provided a locus for control and manipulation. "Page Life" provided an arena for "Question Life," the next "life" described.

Question Life

"Question life" began with unfamiliar information on pages. Questions represented holes and wondering in the

students' minds and became evident only when communicated in some way to the group. When communicated, whether verbally or through gestures, questions followed one of three likely paths: (a) not addressed in session, (b) addressed right away in session, or (c) guided the group toward answering and identification of related questions (spring-boarding), the latter being the most frequent.

An excerpt from a case involving a new baby with abnormal genitalia (Case 121) illustrates how questions focus, turn, and shaped a group's work while in session.

Case 121 **Session 1 Page 5 observe**

Curry: So who's writing these down? What hormones do you want?

[Observer comment: Martha, Gwin, and Twyla all add hormones to test as Mel scribes them on the board.]

Kirk: What would we be testing with electrolytes?

Martha: Urinary tests? [no one heard or wrote it down]

Twyla: Kidneys?

[Observer comment: Scott, Mel, Kirk, and Gwin talk about how a fetus gets rid of waste, their kidney function. This leads to a LI of embryology and urinary system.]

Curry: Are there any other fluid tests you want to do [hint, hint]?

Mel: Is there any way you can tell if the vagina's hooked up?

Martha: Ultrasound?

In this excerpt the group was working to determine the next step. The initial facilitator question led to identification of tests to run, a challenge, a discussion, a learning issue, and five other questions.

To conclude, the bulk of session observations included this kind of question, discussion, question activity as students and facilitators tested and probed the limits of their knowledge and understanding. Every question triggered responses and challenges, leading to more or different questions regulated by the collective interest of the group as a whole. "Question life" explicated and discussed can be a tool for understanding and shaping the PBL process. From questions come learning issues whose "lives" are discussed next.

Learning Issue Life

"Learning Issues Life" began with unanswered questions and dies when their answers are part of the students' mental fabric. Students created learning issues (LIs) throughout each session by identifying areas of scientific understanding they lacked. Learning issues functioned to direct students in finding and using resources to satisfy their lack of understanding. They also served as a topical outline for content exams at the middle and end of each quarter. LIs were organized using seven basic science disciplines and seven levels of organization (Table 12). Students negotiated and voted on LIs at the end of each session to determine which would be selected in preparation for the next session.

Table 13
7 Science Disciplines & 7 Organizational Levels

Science Disciplines	
1.	anatomy
2.	biochemistry
3.	physiology
4.	behavioral science
5.	pharmacology
6.	microbiology
7.	pathology
Organizational Levels	
1.	molecular
2.	cellular
3.	tissue
4.	organ
5.	body system
6.	whole patient
7.	family and community

LI choice and specificity were heavily debated concerning coverage, repeated coverage, depth, and breadth--concerns because of individual knowledge base differences and future performance on content and Board Exams. The following example depicts this struggle:

Case 121 Session 1 Page 6 observe

Martha: Don't forget miosis and mitosis is carried over.

Kirk: I think it will come up again.

Martha: If you're going to pick it, don't forget [it].

[Expanded Observation Note: Martha is frustrated about LIs and how they are being handled. Martha spoke out before on this issue and this miosis/mitosis gives her another chance to make

her point which is - pick fewer LIs and cover them in more detail. Consensus is to pick many LIs and cover as much as possible. They feel the need for introduction to a volume of different material as well as repeatedly revisiting past LIs.]

Martha: I was frustrated today because we had steroids before and we didn't learn, and I'm frustrated.

Gwin: How about if we just pick a few and go over them really well?

Kirk: How do you others feel?

Evidence of this LI struggle was consistent throughout every case, journal, and interview. The struggle was manifested primarily in two ways: deciding what resources to use and how to use them, and handling unpicked LIs. The following is further discussion about both ways of seeing this struggle.

Medical text indexes often drove LI selection, which in turn led to resources. For instance:

Case 108 **Session 1 Page 3 observe**

Kirk: Just to be mean, what does ketones mean? How about the biochem of Ketones as an LI?

Gwin: I guess, anyone have a biochem book? Let's just explore it.

Case 169 **Session 3 Page 5 observe**

[Observer comments: They are deciding what LIs to select. Physiology of the liver is too broad so they are searching the biochem book to help them pick more specific issues. The book has the topics divided by chapters and heading and they surveying those for LIs.]

Case 101 **Session 3 Page 4 observe**

Mel: All right, so we want to put... (she starts to put the LIs on the board using the wording from the text index.)

[Observer question: When you do LIs from a text, does that mean you all use the same resources.]

Mel: No, that's why we pick topics.

Kirk: Sometimes it's a problem, like I had to buy GUYTON because all the LIs we were picking for physiology were chapters in GUYTON.

The practice of using text indexes to select learning issues was a bittersweet one. In one sense, if they had all studied the same information from the same text, they could clarify, confirm, and collaborate during the next session. Looked at another way, using text indexes did not promote identifying and searching diverse resources that could have been shared with the group to broaden their view of the issue.

LIs not chosen were abandoned with the assumption they would eventually come up again. For students who felt a need to understand issues not selected, the group established an informal agreement that any student could choose any LIs not selected as a topic for their own information (FYI). An excerpt illustrates this well:

Case 101 **Session 1 Page 3 observe**

Twyla: Should we do a FYI for . . .?

Kirk: You enjoy those FYIs don't you?

Twyla: I do, I do those first.

[Expanded observer note: FYIs were made up by the group to deal with an LIs not selected. Rather than abandon it, they identify it as an FYI. If it came up later everyone is not held responsible for the information. It's like extra curricular work and some just don't/can't work in this way.]

Kirk: Why don't we just make everything FYI and then we'll cover it all? [sarcastically]

An LIs "life" was determined as students wrestled with the question of which LIs to choose and in what depth or detail to study them. Every LI chosen was recorded and

became an item for independent study and an item for inclusion in the quarter's subject exams. An observation made early in the quarter highlights the LI negotiation process in a way that communicates some of the complexities involved:

Case 108 Session 2 Page 4 observe

[Observation comment: Discussion is followed by voting. This is a very complicated process, deciding what to choose for their independent study.]

[Expanded observation comment: Even though this is only my second case, I can see this is one of the most exciting and agonizing aspects of the case. To craft a decision about the depth and breadth of what to study is a lesson in negotiation, patients, frustration, discipline, and trade offs. It's tough, not because of what is said, but by what is left unsaid - i.e. silent concessions and the fact that now they have to go off and study the learning issues because they are responsible for them even if they didn't vote for the ones chosen.]

In sum, LIs existed through students' identified learning needs. Selecting specific LIs was a negotiation process requiring a group vote, but included some independent selections when students had a specific interest or need. Selected LIs became the topics for their content exams and the LIs not selected were abandoned, with faith they would come up again later. Knowledge of "LI life" and its issues created an opportunity to deal with these issues of concern to students.

PBLP Lives Model Summary

To recap, the PBLP program was comprised of individuals organized into groups who met in session and went through cases page by page to identify questions which generated learning issues about science facts that are unfamiliar. The students were charged with identifying their own resources throughout the program and they assessed and were assessed on a continuous basis. The PBLP Lives Model depicted all these program entities in a way that demonstrated their relationships to each other and the program as a whole.

Decomposing the PBLP program is one way to examine its critical components. Like any system, the health of the entire process is dependent on the health of the subprocesses. Each "life" must work in harmony with the others for the PBLP to thrive; failure to thrive is related to a weakness somewhere in the "lives." This model helps analyze and interpret those "lives", to explain and understand how they work together, and therefore to evaluate their worth in serving the goals of the PBLP.

Typical Group Session

In the very first session the facilitator said, "The function of the group is to focus the learning on things--

there is not a lot of learning that takes place in the group." In response to this I noted: "This is an interesting concept, but I'm not sure I agree. There is a lot of learning taking place in the group setting, but it's not the same kind of learning as that of individual study" (groupwrk, p. 11). Observing and participating in group sessions made that assertion evident. The challenge here is to communicate this clearly so a reader who has not experienced it can draw her own conclusion.

The following descriptive narrative is an attempt to portray what it was like to experience a typical group session. The rendering of this session was compiled using a combination of video taped sessions and session notes. Portraying a session account in this way allows for observations to be frozen and analyzed, in order to identify the explicit and implicit aspects of group work.

The session story moves between selected excerpts and narrative commentary. The excerpts are taken from a set of group session observation notes (grp1_102.doc, May 24, 1994, pp. 1-6) and the commentary adds further description, analysis, and interpretation. The story is presented in chronological order.

Background is needed to set the stage for the story. The group was working on Case 158, Elizabeth Stuart, at the

beginning the second session. The case had started the day before. During that session we heard the major complaint:

Elizabeth Stuart is a 33-year-old woman who comes to you because she has been having unprotected intercourse with her husband for the past four years, and has been unable to become pregnant (Case 158, p. 1).

Following the major complaint was a patient interview via role play (Case page 2), physical exam (Case page 3), and a request for two tests: fertility investigation--normal (Case page 4), and Laparoscopy--adhesions and mild atypia (Case page 5). Page five also stated that Mrs. Stuart failed to schedule follow-up appointments, as instructed, but returned two years later complaining of fatigue and intermenstrual bleeding. The group ended this session by identifying learning issues (LIs) and wrapping up.

Now back together, the group was continuing work on the case after an evening of independent study. To aid tracking, organization, and later reference, titles were added. Each session seemed to consist of five segments: social chatter, front matter, group work, LI identification, and wrap-up.

Social Chatter

I notice even with 4 tables pushed together table top space is at a premium because of all the texts and references brought to session. Starting off, the group typically begins with small talk. Martha comes in with a huge bandage on her thumb and several students ask her what happened--little

kitchen accident. We all know Martha's summer job is selling cutlery, so this leads to some jokes about her future as a doctor with no fingers.

Kirk produced a document listing all the cases so far this quarter with their learning issues. He had made copies for everyone, and he handed them out--more fodder for the table top. Dr. Curry handed out a "first time ever" student evaluation explaining it as something new he's trying. He explained it needn't be filled out until next session, so most put it aside or stuffed it into their book bag.

The length, type, and quality of "social chatter" makes a difference in the rest of the session. That difference could be described as mood or tone and it ranged from somber and quiet to excited and loud. Humor, a helping document from Kirk, and a small diversion by Dr. Curry set a pleasant mood for the session. Social chatter usually lasted between five and fifteen minutes.

At some point early in the meeting someone said something like, "Let's get going," or, "Did anybody find..."

Front Matter

Mel started by talking about her reading concerning the learning issues of the previous session. She was worried about cancer. Gwin shared a book she bought at the beginning of the quarter on infertility that says the first thing you should do is an ultra-sound in cases like this. Kirk said he kept coming down to tumor growths and read some of the symptoms out loud to show how what he had found aligned with the case. Scott reacted to something Kirk said and then talked about pap smears. He was surprised by how much you could tell from that test and shared some of that with the group. Martha, after reading a definition from a medical dictionary said she'd

like to do a blood test. Then Mel, who had started the ball rolling, spoke up again and said, "Oh, there's a lot of things. The intramenstrual bleeding really worries me. That's one of the signs of cancer. There's a lot of things."

The feeling in group during front matter, after a time of independent study, was intense and exciting. It is as if the crackling neurons can be seen as the students shared, verbalized, and rebounded off one another's comments. An observation coded "attention in the group" was recorded. This refers to who was listened to and for how long. Attention in group was a fragile thing, like a Darwinian process of natural selection--the loudest, most persistent, or best timed comments got the attention and held it until another question, comment, or statement guided the group in a different direction.

There was a sense frustration at times from the lack of closure and sometimes "jerkiness" of the conversation. Questions or comments often got preempted, ignored, or overtaken by other questions or comments. The lack of closure was handled differently by the loud, medium, and soft speakers in the group. I noted that perhaps someone should have been keeping track of the unattended questions and comments. But I also noted they got their work done--maybe the process is fine.

Group Work

After Mel's comment the group slipped into a thoughtful silence. The facilitator let the silence last about a minute and then broke it by asking who was serving as reader for the session. The question prompted them to jump back into the case. Scott, yesterday's scribe, started things off by presenting a synopsis of the case to date by flipping from one case page to the next, picking out important facts to mention.

Sometimes case presentations were well prepared and presented with confidence from written notes or memory. On other occasions it was just mechanically read page by page as presented, indicating no time spent in preparation for presentation. Usually though, it was something between these two extremes. Today, it was just read.

I noticed a qualitative difference in the group session concerning this process of preparing and presenting. The group appreciated and perked up after a well presented summary - the energy, pride of workmanship, and confident understanding were infectious. On the other hand, they slouched and looked bored when the case was chopply presented from case pages without any evidence of preparation. One can only imagine what would have happen if they had all come prepared to present.

Mel, Kirk, and Gwin are now convinced the Mrs. Stuart has cancer, and they say so. Martha wants to find out for sure. Since there was a two year lapse since her last visit, they decide they will have to start over with another patient interview. Before they start though, there is more discussion about adhesions and what causes them. Gwin and

Mel relate what they read about adhesions during their independent study and Kirk asked where they found that information.

Twyla plays doctor and Mel plays Mrs. Stuart and they repeat the interview process, writing facts on the board and generating hypotheses to be explored. This is followed by a call for the physical exam (PE).

Typically, in the beginning of a case, the first few pages were "called for" by the students. These pages flowed rapidly until they hit the physical exam (Case page 3), or later pages containing various test results (Case pages 4-n). The "call" for a page or a test served to move the group along to more information on the case.

Sometimes, an individual would have an idea about the next step and made the "call" to confirm or deny it. Other times, various degrees of group collaboration drove the "call." In other instances, a student would suggest a test or treatment and the facilitator would just hand out the page without ever having a "call." Ultimately, the facilitators decided if the group was ready to move forward with the next page.

Observing this process was reminiscent of Robert's Rules of Order for general meeting etiquette. The "call for page" was akin to the "call for question." According to the rules, after an item on the floor has been thoroughly discussed, anyone in the meeting has the right to "call" for a vote. Using this analogy gave a way to

think about this phenomenon and an idea about how the process might be organized to make it more manageable.

Martha reads the physical exam which contains a gynecological exam reporting "a massive cauliflower lesion replacing the cervix" (Case page 8). Twyla, Kirk and Mel all have different reactions. Twyla says, "[i]t sounds like the picture in the text," Kirk says, "[s]tage III," and Mel says, "[s]he makes me mad, this patient!" Mel went on to talk about a patient in her ongoing preceptorship with bleeding and how she had "been sick about this [paper] patient since page one."

After the first few pages of complaint, interview, and physical exam, the students went into a cyclic mode of identifying tests, receiving new information, revising hypotheses, picking learning issues, and doing independent study before coming back together, sharing, and moving on. To continue:

The facilitator asks, "What are your main concerns at this time?" After some discussion Gwin "called" for a biopsy. To their surprise there wasn't one and the facilitator was not sure why. Scott read from a text recommending a Cat Scan or MRI so the students "called" for both which prompted the facilitator to distribute page nine, a Cat Scan. Several unfamiliar terms and tests were on this page which sent the students on a hunt through their reference books to define the terms, find the tests, and try to figure out what to do next.

This "hunt" was another easily and frequently observed phenomenon. Unlike traditional learning where students are told what to memorize, these students "went after" understanding. Typically, when students encountered something they didn't understand, they would either inquire of the group or take it upon themselves to search for a

resource to satisfy their need to know. Often the whole group would lapse into silence as they searched for information.

Watching them search was like watching the fox after the hound--they had the scent and they were determined to track it down. If the group worked in harmony until someone found the information, the process worked well. However, an individual or a selected group of students on a "hunt" caused problems. While they hunted they were neither listening nor contributing to the group. Therefore, when they "came back" to the group they were lost, and to catch up they had to be debriefed by someone. Debriefing further impacted the session.

However, when a solo hunter found what he was looking for, and shared it with the group, enrichment occurred. But this too caused an interruption in the session flow and required the hunter or hunters to debriefed.

Kirk asks, "[d]o we want to prescribe treatment?", to which Gwin says, "[s]eems to me we have to present the options to her because this is a case where she has to make some quality of life decisions but I don't feel I know enough to do that at this point." Kirk then says, "[w]ell, we need to identify some learning issues."

Although Kirk was ready to start identifying learning issues, Twyla, the scribe, started talking about resources; and the conversation turned to resource cost, readability, pictures, currency, breadth versus depth, basic or clinical information, and prescriptive or descriptive text. During that conversation Scott had been searching some texts, found what he was looking for, and read aloud the kinds of treatments available for

this type of cancer. Scott's comment triggered Gwin, and she turned the conversation back again to behavioral science issues concerning quality of life, insurance, hospice care, and cancer patient options. She asked the facilitator if the case had any information about that. It didn't.

Kirk suggested radiation prompting the facilitator to hand out the next page. It came with a detailed two page explanation accompanied by four x-rays. There were many unfamiliar terms and learning issues generated by this page. Before ending they had a good laugh talking about a student in another group, offering twenty-five dollars to the other students to not choose a learning issue that was 75 pages long (Case page 10).

The democratic nature of the conversation caused it to jump, skip, slow or speed, and change direction in mid-thought. Students searched, verbalized, passed books around, read silently and aloud from texts, and vied for attention. Instead of one story, the group session was a cacophony of sub-stories blending together.

The accompanying actions of this intense scene were equally difficult to summarize. Some of the students had two or three texts open in front of them which were swapped out for other texts as the conversation changed. When x-rays or other visuals were distributed many students left their seats and congregated at the visual. Never once did the word "bored" enter the observation notes.

Identifying Learning Issues (LIs)

About one-half hour before the scheduled end of session Twly, the scribe, begins a vote on the learning issues to choose for independent study.

These are selected from the list of all the learning issues generated in that session. They choose carcinogenesis, cervical cancer, radiation therapy mechanisms and "for your information (FYI)" on drugs.

LI negotiation was interesting because the students realized the issues they picked were used to generate their content exams. The implication was, the more specific the learning issues, the more specific the test questions because they were only tested on the LIs they selected. Of course this strategy could only go so far because they had also to consider the National Medical Board Exams they would have to take.

Wrap-up

The last order of business for each session is the "wrap-up." The wrap-up for this session was a series of questions by the facilitator concerning the case and the PBLP evaluation process. A rich discussion followed about whether there should be any exams at all in the PBLP. Scott thought he wouldn't study as much if there weren't but Twyla said she would study harder. Kirk said he'd be relieved and Gwin thought there should still be exams but they shouldn't count. Mel remained silent.

Typical Group Session Summary

A typical session like this serves as a good illustration and summary of the PBLP process at work, and provides the framework for developing understanding of the following sections. Most of the session involved ongoing

group dynamics. In talking about group dynamics Kirk said, "I'm finding that group dynamics, like everything else in life, is a balancing act. It takes some willingness to lead, but also a willingness to step back and let others exercise their strengths" (groupwrk, p. 5). Each segment of the session, looking at in this way, is highlighted for analysis and interpretation.

In summary, social chatter set the tone and front matter was an intense time of sharing but could get frustrating, depending on how attention was handled. Group work involved the "presentation," the "call," and the "hunt," and attention jumped around depending on who controlled the conversation. Identifying learning issues was a focused time of negotiation, and wrap-up was an open-ended forum for getting and giving feedback or handling special topics. In this environment a person would have to work hard not to be totally engaged.

Patterns Observed

Elliot Eisner (1991) writes about the role of qualitative classroom research in helping participants and practitioners understand the social constructs they are experiencing. He says,

The interpretation of events in schools and classrooms is seldom the result of single occurrences. The sense we make of social

situations, the meanings we assign to action, and the motives we infer from what we see are typically built up over a period of time. They are iterative. Like markers along the way, they plot the past and provide cures to the future. . . . Predictability increases (p. 98).

Observation revealed recurring patterns that helped define the nature of PBLP and provided a vocabulary about the process and program. Four patterns were observed, and illustrative figures were developed to describe these iterating patterns: (a) case flow, (b) session flow, (c) influence model, and (d) a confidence versus volume graph.

Case Flow

Cases were stories revealed page by page over two to four days. Each case, like a good story, introduced a character, built to a climax (diagnosis), and finished with an ending called a treatment procedure. Although case emphasis was directed toward understanding basic scientific disease mechanism, the motivation from the student's perspective was clinical--diagnosis and treatment. Case information began with the major complaint, spiraled up to diagnosis, and then tapered off to the final treatment (Figure 4).

Visualizing the case in this way provides a vocabulary and analysis of how cases work. The diagram gives a "big picture" of the case, which could not be seen by looking at

the PBLM. The diagram also illustrates how a case is holistic, contextualizing and relating all the knowledge

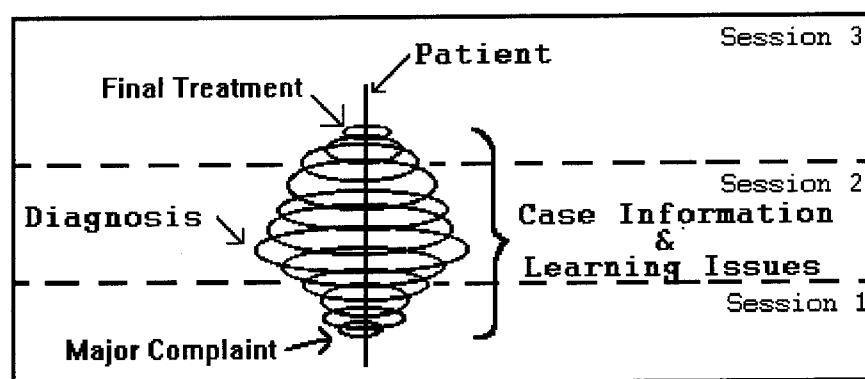


Figure 4
The PBLP Case Information Spiral Diagram

associated with the case together. Theoretically, developing knowledge that is contextual and related aids future recall. Finally, the diagram highlights relationships between patient and case, case and information, and information and diagnosis.

The patient is central in this model and everything around him or her. The spiral represents case pages and LIs. The LIs were identified, studied independently, and then discussed again during the next session. Finally, most cases occurred over three sessions and the diagnosis served as the case climax.

Session Flow

Session flow was determined by case information. As each new page of information was presented, the group began anew to decipher, assimilate, and identify their current knowledge and knowledge needs. Case pages drove this process, which can be visually depicted (Figure 5).

Each page challenged students' understanding, but did not take them completely back to square one. As the students interacted and searched for information, their level of knowledge and understanding increased. When they get to a point when questions, comments, and stories are exhausted, they "call" for a new page and the cycle repeats.

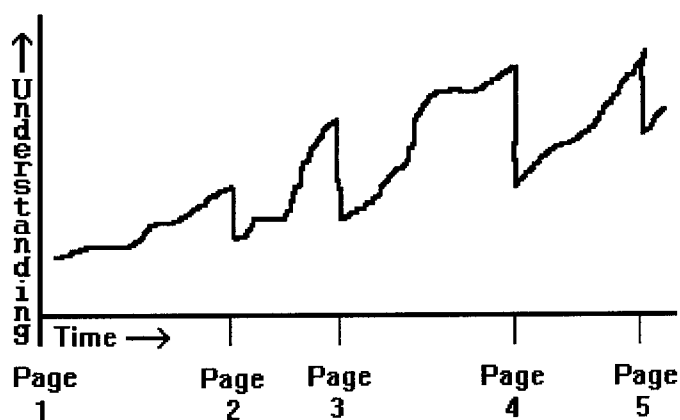


Figure 5
Visual Depiction of Increasing Case Knowledge
During a Typical Session Covering Several Case
Pages

Seeing and knowing this pattern clarified how the PBLP worked, alerted students and facilitators to session nuances, and provides an understanding of session flow. Group and individual frustration, stalls, and heavy searches could be seen as an uphill climb that took place between pages. The pattern also offered hints about where to break for the day and when to distribute the next page. Knowing this pattern could aid the group process and ready them to exploit session flow in an informed way.

Influence Model

A frequent and easily observed pattern of group work was the influence each individual had on everyone else (Figure 6). Unlike traditional education where students only get

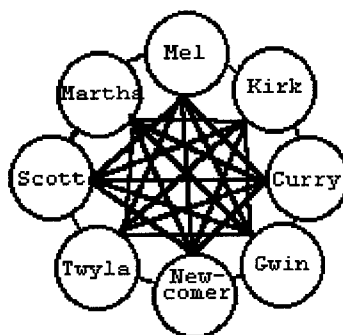


Figure 6
PBLP Group Influence Model Diagram

information from one source, each person in this setting got information from all sources. The strength of this model can be observed as every individual shared their perspective, giving others a new way to think about their knowledge.

Part of the power of the PBLP is the cross pollination seen in this model. Like a neural network, group members processed ideas and questions while hunting for answers. Learning to work in this influence network is a part of the future when interactive networks change the way we live and work, and when total quality management requires cooperative decisions based on input from everyone associated with a process.

The influence model highlights the complex relationship patterns among group members. Each group member, by virtue of the curriculum design, took on responsibility for his own learning and contributing to others. This model has great potential for both positive and negative impact depending upon how this responsibility is understood. If students use it as a crutch it can negatively impact their future learning.

The literature suggests that students may not be able to work autonomously because of a dependency upon the group in PBL. Posing this hypothesis to Will in our interview, he rebutted that statement:

[Question: What do you say to the critics who say doctors need to be able to work autonomously? If you're sent to the reservation you're not going to have a team to work with.]

Tim: I think that's true, there may be times when we do have to work alone but we've been given two years where we've not practiced that way [alone] and where our line of thinking has been molded and influenced by someone else's line of reasoning and logic, and you can draw upon that and you can integrate some of their approaches and problem solving abilities into our own. So yea, all of us certainly may be faced with that but I don't feel it's a draw back. (int_will.doc, p. 2)

Confidence Versus Volume

When students shared information in group, they were accountable for the accuracy of that information. In the PBLP group, this resulted in an observable phenomenon concerning the amount of confidence students had in their their information (Figure 7). Typically, if they were sure

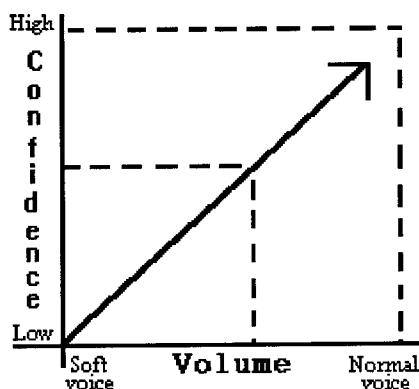


Figure 7
Confidence Versus Volume Diagram

of they used a normal tone and did not shy from sharing. If, on the other hand, they were speculating or probing, their speech was less confident and quiet.

A good example of this occurred in the first case on multiple sclerosis as the group was discussing the blood-brain barrier, something they were unfamiliar with.

Case 143 Session 3 Page 4 observe

Mel: In terms of MS, from what you read we have a breakdown in the blood brain barrier.

Gwin: Say you have a infection as a child, that weakens the barrier and then later in life, if you have another infection, that may trigger it.

Martha: Now I'm remembering something that we had last quarter maybe they were never exposed to these things but then they get trapped in there.

Twyla: I think the blood brain barrier doesn't form until about one year.

Curry: Why are you whispering?

Martha: Because we are uncertain.

[Expanded observer note: The volume of the talk is a nonverbal indicator of the speaker's confidence.]

Cognizance of this behavior pattern could aid facilitators and students in judging whether what is said is fact or speculation. Sometimes, however, a student will speak with confidence but not have their facts straight. For example, Gwin said of a student in her last group:

[S]ome people can sound like they're speaking with authority when really they don't know what they're saying. Their misleading or false information is believed which is detrimental to the group process and individual learning. It becomes our responsibility to verify everything that is said and to point out when mistakes are made. . . . In my last group, one really likable, smart, outspoken guy would hypothesize under the guise of relaying facts. People rarely challenged him

because he was such a nice guy, and as a result we ended up chasing our tails a few sessions.

Because of situations like the one Gwin relates, this behavior pattern should be used with care. In general, though, the confidence versus volume relationship is telling.

Patterns Observed Summary

The four patterns of case flow, session flow, influence model, and confidence versus volume help answer the question, "What is like to be in a PBLP group session?". The patterns present a depiction and description of relationships at work among curriculum elements. These patterns, along with the PBLP Lives model and typical group session, aid in analyzing and interpreting the research data.

The case flow diagram permits visualization of an entire case and its important relationships. Session flow can be seen as a graph diagram, implying a regular pattern to session work. The influence model is an interpretation of how participants are interconnected. Finally, the confidence/volume diagram is an interpretation that provides a beacon for judging the strength of understanding when things are said in session. These consistent patterns provide new ways to think about what it's like to be in the PBLP program. In THE last section of this chapter, six

aspects of group work answer the "what's it like there?" question.

Key Elements of the PBLP Experience

Six key elements were chosen based upon their importance to the process, the quantity and multiplicity of evidence, and judgment of what seemed to be important to the PBLP program: (a) group bonding, (b) science coverage, (c) frustration, (d) group leadership, (e) humor in group, and (f) individual perspectives on the PBLP process. Each topic is derived from the data codes and is referenced for researcher purposes only using the code filenames and page or file headings.

The dialog that follows is comprised of excerpts accompanied by analysis and interpretation. The goal of this section is to show, rather than just tell, what it is like to be in a PBLP session. Therefore, this section draws heavily from the students words.

Group Bonding

Group bonding refers to the cohesion of the small group--the students support and empathy for each other, and caring for one another. The more support and empathy, the more the group bonds. Bonding is an emotional dimension that

constantly fluctuates but generally strengthens as students interact with each other.

From a theoretical perspective the PBLP process is designed to be successful whether students bond or not. The data, however, tell a different story. Bonding played a significant role in the quality of the PBLP experience.

On a surface level PBLP students had much in common and were acquainted with each other. As Jim says, "I think there are only two or three [PBLP students] I don't know really well and the rest of them I feel really comfortable with. I feel a real bond with them ..." (groupwrk.doc, p. 2). In group, however, bonding took place little by little through shared experiences.

The importance of bonding was articulated by Will. In his journal he wrote:

The bonding is very important. We discuss many delicate issues in depth. The ability to relate and communicate our feelings and thoughts to others includes the process of making contact emotionally - "bonding." . . . Some bond better than others, but all will bond in one form or another (groupwrk.doc, p. 1).

As an example, he related a facilitator's personal story about the loss of a loved one, and he described how his group rallied to one of their members who was having a particular problem. As these occasions accumulate the group bonds.

Gwin provided a wonderful summary of other indicators of group bonding in her journal entry, saying:

[C]lass is going more smoothly. Fewer disagreements about learning issues, fewer awkward silences, times of waiting on the facilitator to guide us. People assume roles rather than waiting to be assigned, joking and laughing are more frequent, and people seem genuinely interested in each other as people - not as competitors. . . . I think that means we're more comfortable around each other now - we're not as afraid to make guesses or to admit ignorance or lack of understanding as we were in the beginning when we all seemed to need to prove/assert our intelligence and competence. I think we're working together much better now - there are fewer side conversations, people in general listen to each other (groupwrk.doc, p. 6, & 12).

Gwin mentioned twelve indicators, some easily noted, sensed. Like many concepts, however, bonding is hard to describe but it is evident to those who have bonded.

The timing of bonding was an uncontrolled variable and depended upon opportunities not easily explained. As Scott penned in his journal about half-way through the quarter: "Maybe our group has gotten over a mid-term hump, since we seem to be functioning better than three weeks ago. There doesn't seem to be any conflict, but that's from my perspective" (groupwrk.doc, p. 5).

The data on group bonding suggests it is an important part of the problem-based learning process. The inference is, the more bonding within the group, the better the PBLP process works. The implication is to understand this bonding process and build it into the program.

Coverage

Coverage refers to the resources selected and how they were they used, and the scope of medical knowledge in relation to the seven science disciplines and seven levels of organization (see Table 13). There are two dimensions of this coverage: selection and depth. To begin the session students tried to find out and/or get a feel for the study others had done from the previous session. Just because they voted to choose the same LIs did not mean they studied them in the same way or to the same extent. The level of detail of study varied greatly. One student would read a whole chapter and another would just read a section. Because of these factors, the students probe each other to find out the resources selected, and depth and breadth of LI study. The following example illustrates typical both selection and depth quarries:

Case 143 Session 3 Page 3 observe

Martha: Did you guys go into embryology?
[selection]

Case 131 Session 2 Page 3 observe

Kirk: How far did you guys go into bacteria?
[depth]

Kirk: Did you do cultures and how they work?
[selection]

Gwin: There's a lot in strep. [depth]

Case 136 Session 2 Page 2 observe

Kirk: Did you guys end up doing the pathology?
[selection]

Case 110 Session 3 Page 1 observe

Martha: Where did you look for ducts, or glands?

Gwin: It was in the epithelium chapter.
Kirk: So you did the whole epi chapter? [depth]
Martha: I did the glands part. [selection]
Mel: I did the glands part to. [selection]

One problem with their study was that sometimes they had read chapter 10 but not the introductory chapters. Mel, when asked how to deal with that, said:

I just started reading path and they started going into the molecular basis of cancer. It's like, I'm not prepared to do this yet. And so then I got on my cell book and it was hours, just hours . . . (coverage.doc, p. 2)

The burden of identifying and covering what they needed to understand in order to study the LIs is a given.

Unlike traditional curriculum, where students are told explicitly what to know, these PBLP students had to have faith that the cases selected provided them with the opportunity to know what they needed to. Their faith was illustrated by an interview comment from Gwin who said:

I just ... say okay, I'm going to do the studying and it's up to the people that are directing this program to make sure I cover what I need to cover. I know we pick our own learning issues but to a certain extent they direct our leaning by picking cases which determine our learning issues. I just have faith for them to point out when we are not meeting our goals. That's all I can do ... (coverage.doc, p. 1).

NMBE I scores from the previous year's group was another indicator of whether the PBLP was giving them what they needed. Jim says:

I think the things that influenced my feelings the most on that [coverage issue] were the results from the last PBL'rs. They scored higher than the national average and I fell back on that. If I

can just keep up with the group, keep up with the class as a whole, I don't feel like I need to worry about it (coverage.doc, p. 2)

Determining the selection and depth of coverage was a major activity at the beginning and end of each session, and in independent study. Knowing about this key element and understanding its influence within the PBLP process suggested that strategies could have been developed to communicate what's been covered and with what resources. Making this an explicit part of the group process could avoid much session guess work.

Frustration

"Frustration is a deep chronic sense of insecurity and dissatisfaction arising from unresolved problems or unfulfilled needs" (Webster, 1977). The major problems and needs of the PBLP students was lack of knowledge, and frustration was the word they used to describe it.

Case 169 Session 1 Page 2 observe

Gwin: I was frustrated because I thought I knew more than I did.

Scott: I was frustrated last night. . .

Case 131 Session 2 Page 4 Gwin Jrnl

I felt frustrated today. I didn't have the grasp of the information that I thought I did.

Case 110 Session 3 Page 6 observe

Mel: I was frustrated with my lack of knowledge of GI [gastrointestinal].

Frustration was particularly high when starting a new case.

Case 121 **Session 1 Page 3 Gwin Jrnl**

Starting a new case is always frustrating. All of the unknowns: clinical, basic science, make us impatient, nervous, cranky and worried.

Case 121 **Session 1 Page 1 Scott Jrnl**

Today's session was certainly one of the tensest one's I've been in. I've been in several session which have been personally frustrating before (as usually happens when we start a case we know nothing about), and today's was similar.

Case 101 **Session 1 Page 12 Will Jrnl**

We knew we had a tough case today. The signs and symptoms are confusing. This is a little frustrating. . . .

Although frustration carries a negative connotation, in this setting, it was often talked about as an asset. Gwin mentioned that even though it's frustrating finding out how much you don't know, she would "rather find out now than on the exam at the end of the quarter" (frustrat.doc, p. 3). Will, too, stated that frustration generated "good discussion" (frustrat.doc, p. 4).

In session, frustration came from many causes; lack of time, facilitator's questions, group dynamics, pace, leadership, coverage, lack of closure, and personal reasons. Typically frustration was not verbalized but rather was seen in the tone and demeanor of the students. For instance, Dr. Newcomer, talking about session during the wrap-up, said, "I noticed frustration. . ." (frustrat.doc, p. 1). I asked him to describe specifically what he saw that made him think they were frustrated. He said, "I heard it in the tone of their voice and I saw it in their face and body--furrowed

brows, downturned mouths, intent looks in their eyes. It's hard to describe but not hard to detect" (frustrat.doc, p. 1).

Frustration was a key element implicit in the PBLP curriculum. Explicating it through the students' and facilitators' words makes it assessable for review and discussion. Frustration has both positive attributes and negative attributes. The challenge is to harness and exploit the positive, and minimize the negative. The motto of PBLP should be, "Frustration is our friend." Some students hinted at this, but it was never made explicit.

Leadership

Leadership is "the art of influencing and directing people . . . in achieving a common objective" (Varner, 1988). Put simply, leaders guide and direct the actions of others. They are ordained with the responsibility to accomplish one or more objectives. The success they experience in reaching their objective depends upon the goal, authority, experience, knowledge, and understanding of the leader and those led.

In group work, someone has to lead. In the PBLP, group leadership was serendipitous. Since there was no formal leader or agenda, interruptions often led to changed direction, without closure or a return to original paths.

The facilitators were the leaders, but only in the sense that they monitored and kepted the group within certain boundaries. Within those boundaries students were free to roam where they wished. The leader, therefore, was the student or students who assumed leadership through their role, or through their participation in the form of comments, questions, and/or suggestions.

During session, one student was assigned the role of scribe: writing facts, hypotheses, tests, and learning issues on the board. By virtue of the role, that student often played leader. As Dr. Curry was fond of saying, "The person with the chalk has the power" (personal conversations, 1994). However, the scribe's leadership was not explicit and the level of leadership varied greatly depending upon who was scribe.

Since there was no assigned leader, questions such as "Where are we?" or "What are we doing?" were common. Although Gwin stated the group was "more of a consensus driven group" with no "leading-the-charge" leader, it was not hard to identify the group's natural leaders (leadersh.doc, p. 4). The most vocal and directive of the group was Kirk. He knew this about himself and, according to his journal, tried an experiment to see what would happen if he restrained from leading.

Case 131Session 1 Page 1 Kirk Jrnl

I often participate too strongly. . . . I feel as if one of my roles in the group has been that of leadership and so I decided to try and keep quiet. . . . My first thoughts: Wow! It's quiet in here! And we will get nowhere fast at this rate. . . . As our time progressed, I began to watch Mel emerge as a new leader. Is it the common desire of all people/groups to need a leader? . . . It takes some willingness to lead, but also a willingness to step back and let others exercise their strengths. Perhaps it is all part of leadership.

Other students emerged to lead the group on other occasions when their interest, expertise, and personality allowed.

The topic of leadership was discussed in personal and group interviews with specific emphasis on the idea of an assigned formal leader. Reactions were mixed. Mel, speaking for the group, said it best:

I've thought about this a lot and for me personally I don't think I'd want anyone to be a leader. I don't think I could take that kind of role in terms of time, taking notes and stuff. This is what we would need to do. But then again, I hate that when somebody tries to be a big leader. I do feel you need a direction or a focus. I don't have a big problem with somebody not being leader. I think when you have somebody as a leader, and they are a good leader, then you won't have some people speak up. Stacy has said that if there were somebody who where more strong she would be more quiet (leadersh.doc, p. 4).

This statement highlights five aspects of leadership repeatedly observed in the group. First, being a leader was work, and they already had enough work. Second, leaders emerged, and the job they did ranged from great to gross. Third, there was often an overwhelming sense that a leader was needed to direct and focus the group work. Fourth, the

reality was the work was getting done without a leader. and fifth, if one person was assigned as a leader, the others might have refrained from leading.

Implications from these observations suggest the concept and practice of leadership within the PBLP program is in need of attention. The decisions made about leadership may not matter as much as explicitly stating what, if any, the PBLP program leadership roles and responsibilities are.

Humor

Observation revealed that humor played a huge role in PBLP. Of all 72 codes, humor ranks eighth in frequency of occurrence. However, determining whether something was humorous or not is very contextual--you had to be there. Student comments and several humorous events illustrate why humor is a key PBLP element.

Several students talked in interview or wrote in their journal about the role of humor from their perspective. The following excerpts provide a summing quality concerning humor in the PBLP program.

Case 110 Session 3 Page 12 Will Jrnl

Sometimes it [humor] is good to break the tension of a discussion. Sometimes it helps to value everyone as a transition into another topic. Sometimes it can help us grow closer as a group. Humor is a good device within a group setting. It helps to bridge the gaps from subject to subject, alleviate tension, break the ice. It helps us bond as a group or it even may point our

misunderstandings that can be addressed. In our group this quarter we have had good use of humor.
 . .

Case 129 **Session 2 Page 1 Scott Jrnl**

Today was the second day of our erective dysfunctional patient. Plenty of funny moments . . . It's interesting to see how humor helps to bond people together better. Not only are you having a good time, but productivity is good, if not optimal. The point is, to make learning as fun as possible, and when the process is enjoyable, everyone benefits. I think a good lesson in interpersonal skills is learned here which can be applied to the future and the real world: unless the circumstances rule against it, a smile and a sense of humor do make a big difference.

Case 108 **Session 3 Page 2 Gwin Jrnl**

Today seemed much more relaxed than Tuesday. Humor was prevalent which I think is a sign of 1) the increasing comfort of the group members with each other and 2) a healthy group and individual way of dealing with stress (probably in this instance the stress produced by the previous seminar.) I think that humor is essential to a successful group, and I think that is a good barometer of the group's developing interpersonal skills. Toward the end of last quarter, my group was almost constantly in stitches. People joked all the time and that was not an obstacle to learning; in fact, I think the humor made group seminar smoother and more productive.

Page 4 **Int Mell**

I think it makes it easier if it's more fun, if you can laugh, it makes medical school not such a chore. I think sometimes my roommates resent that this whole year I've just been saying what a great year it is and how I've been having a great time. I feel like I've learned so much this year.

Although humor occurred spontaneously in the PBLP environment, certain situations promoted humor more than others. Role playing at the beginning of each case, especially one involving any kind of sexual innuendo, tended

to be humorous because of the lack of information and the sometimes sensitive nature of the questions asked. For instance, in Case 158 a woman was unable to get pregnant. In the normal course of the doctor-patient interview, she could not recall how old her husband is, if he has ever sired any children, or how many sexual partners either he or she has had in the last ten years.

A second plentiful source of humor is jokes and stories. Once, upon hearing an access buzzer outside our meeting room, Dr. Curry shared a story about another group who was conducting a role playing interview near an area that used a buzzer for entry. An interview question had to do with having any extramarital sexual activity, and as soon as the subject said no, the buzzer went off. He said there was a moment of silence and then everyone broke out laughing.

There was also a running joke. Mel, by virtue of her foreign travel, personal history, and friends, apparently had been exposed to many diseases. In every patient case, she either had the disease herself or had a friend who had the disease. We joked about not wanting to be Mel's friend and we all got a big laugh one day when Twyla said, "I have a friend that has cyctic fibrosis...", and someone commented, "congratulations on having a sick friend--so Mel isn't the only one" (humor.doc, p.1).

Putting these examples together paints a picture of a group having fun and learning. According to testimony and personal experience, humor has many advantages and it never seemed to be out of place, although some of it, taken out of the context of that setting, wouldn't be funny. A favorite Bible verse of mine says it best - "A cheerful heart is good medicine." (Proverbs 17:22, NIV, 1985).

Students Perceptions of the PBLP Process

Students were asked to describe their view of the PBLP program according to their likes and dislikes, and if they felt the program met their expectations. With one exception, they all felt the program met their expectations. (Kirk thought the program was set in a hospital dealing with real patients instead of in a room with paper patients.) Four themes resulted from the request for information: (a) active participation, (b) enjoyable program, (c) learning to work with others, and (d) holistic, meaning working on all aspects of a patient instead of studying isolated disease mechanisms.

Active Participation

In active participation, active is the operative word. The students controlled, through their actions, what got

studied and consequently, what they got tested on. Students mentioned choosing the PBLP partly because they knew active learning is better than passive. In the first student interview, Jim said, "my own gut feeling [is] that you learn more when you actively participate" (pbl_proc.doc, p. 1).

These students also knew the value of learning how to participate. This is illustrated by Gwin when she wrote in her journal, "I think and know it's important for me to develop the confidence to speak up and to be more participatory" (pbl_proc.doc, p. 1). I think Jim said it best: "It's the opposite of passive learning" (pbl_proc.doc, p. 1).

Enjoyable Program

When Jim was describing how he would tell others about the PBLP he said, "You can see the application of what we're learning and how we're going to use it later, and for me personally it just makes it a lot more exciting" (pbl_proc.doc, p. 1). Likewise, Mel said, "I really like the program a lot and I like the people. . . . The program is everything I hoped it would be" (pbl_proc.doc, p. 1). Even Dr. Newcomer noted "the joy of learning is obvious in the PBL students" (pbl_proc.doc, p. 1).

Learning to Work With Others

Many students mentioned that working and interacting with others is a PBLP highlight. Gwin said, "its not about what we're learning, it's about how the group interacts." She added that the program "forces you (not in a bad way) to meet people that you wouldn't ordinarily associated with" (pbl_proc.doc, p. 3). Mel noted the best part of the PBLP is "[l]earning by cases and with other people" (pbl_proc.doc, p. 3). Martha, too, expressed her sentiments about group work, saying, "You'll have to learn to collaborate, you have to learn to work with other people, peers, sharing information, sharing your ideas, sharing places where you can find information, they're not learning that in LD" (pbl_proc.doc, p. 4).

Holistic

Finally, students declared the PBLP promotes holistic learning through cases, instead of learning by individual subject matter. When asked what the strengths of the PBLP were Martha said, "Obviously we're thinking already in terms of cases and how to approach a patient as a patient and not just something out of a textbook" (pbl_proc.doc, p. 5). Mel said, "we started thinking holistic at the start of every

case when we ask, Why does this person have this? and What is it and what do we have to do?" (pbl_proc.doc, p. 2).

In summary, students liked the PBLP because of active participation; it made learning enjoyable, they got to work with others, and they learned holistically considering all the aspects of a patients problems. From a participant observer point of view it looked and felt like a great way to learn. Last, as a first time facilitator, Dr. Newcomer declared in his journal:

In the first two sessions, I was converted to a "believer" in this program. What is clear . . . is that these students are highly motivated to learn and understand, rather than being resentful about what they are told to study.

Chapter Summary and Conclusion

Analysis finally makes clear to researchers what would have been most important to study, if only they had known beforehand. . . . The challenge is to make sense of massive amounts of data, reduce the volume of information, identify significant patterns, and construct a framework for communicating the essence of what the data reveal" (Patton, 1990, pp. 371-371)

Through analysis and interpretation of data, the PBLP program can be seen as nine distinct "lives," a session with five segments, four consistent patterns, and six key elements. I don't pretend this is all the PBLP is, but I do contend that these interpretations are true to my

observations and the participant's views revealed through interview and journals.

Uncovering the PBLP "lives" of learning issue, question, page, case, session, individual, group, assessment, and resource provided a way to investigate the integral parts of the PBLP. Each "life" is joined with the others and hierarchically placed in a specific role of supply and dependency. By breaking them into life systems, they can be dissected in a way not available through any other means. The PBLP Lives Model provides a full bodied vehicle to use in discussing the program and setting the rest of the findings in context.

The typical case session outlines five session segments: social chatter, front matter, group work, identifying learning issues, and wrap-up. Each segment has special characteristics that make it unique and allow it to be identified as a variable to be studied. The session description also provides a frame and foundation for understanding the patterns that follows.

The four patterns of case flow, session flow, influence model, and confidence versus volume provide another way to look at the PBLP. Visually depicting these patterns allows analysis and interpretation to be done using the diagrammatic models. The patterns lend themselves to visual

thinking which can provide fresh insight into the group session process.

Finally, selecting and discussing the key elements of the PBLP, which include group bonding, coverage, frustration, leadership, humor, and student perceptions of the program, allow a closer, more specific analysis of what is important to the PBLP process. Arising from the data, each key element offers concrete insight about the research question of what it's like to experience this curriculum. Using this spotlighting technique of highlighting one aspect at a time gives a concentrated interpretation otherwise unavailable.

The conclusion from these four sections is that the PBLP is a complex curriculum design. Under close inspection the PBLP program is a robust program that finds its strength through multiple components. Each component, whether it be a "life," a segment, a pattern, or a key element, has a fabric of its own which contributes to the program. From the journal of inspection, illumination occurs, descriptions are rendered, a language is developed, and improvements can be suggested.

CHAPTER VI

DISCUSSION AND RECOMMENDATIONS

Introduction

The most important test of any qualitative study is its usefulness (Eisner, 1991, p. 58).

The focus of this study is twofold: to understand the problem-based learning curriculum design in general and in practice, and to describe, from a PBLP group's perspective, what it is like to experience that curriculum. The findings are presented in four formats: (a) PBLP "lives," (b) diagrammatical patterns, (c) a typical case, and (d) key PBLP elements. These formats are of two kinds, visual and verbal. The first two are visual in the form of diagrams allowing aspects of the PBLP curriculum be seen. The latter two are descriptions of a typical PBLP case session and six key elements of the PBLP group work.

The purposes of this chapter are to discuss the findings and recommend ways to make them useful for problem-based learning practitioners and students. The chapter is divided into six parts--one for each of the four interpretation formats, a conclusion, and recommended future research. The order of discussion for the interpretation formats is from the visual to the described and from general to specific.

The diagrams and descriptions allow relationships to be realized and they are useful for explanation, reflection, management, evaluation, and review. The visuals are particularly good at representing the whole and its parts. The descriptions serve to explicate and provide a name for session segments and key elements. Both the visuals and descriptions provide tools and ideas that can be used to inform and improve the PBLP program and PBL in general.

Entities of the PBLP

The PBLP Lives Model (see Figure 3) breaks the PBLP program down into manageable parts that, given names, can be used to understand and improve the process. Its foremost strength is visually depicting the PBLP as a whole, made up of discrete parts, arranged in a hierarchical but interrelated order. Once rendered in this way, supply and dependency relationships become evident, and a new vocabulary is created for further discussion about the program.

Each higher "life" supplies the foundation for the next "life." All the "lives" depend upon each other for the whole system to work well. The model permits a "life" to be "pulled out" and examined.

There are several ways to use this model. If a problem exists in the program or group the model could be used to

analyze where the problem may be, how it affects other areas of the program, and what might be done to correct it. Also, the model provides a map for use in curriculum planning to hypothesize and evaluate how selected aspects of the curriculum effect other areas.

The model provides a way to "put your finger" on a problem. It can serve as a note pad for triggering observations concerning a specific "life" which can then be used as feedback during the wrap-up or program improvement. It could also be used as a tool for explaining the PBLP program to non-PBLers. By seeing the whole broken into parts, the parts can then be divided into their constituencies. This decomposition allows for further analysis of the PBLP program.

In summary, visualizing the PBLP Lives Model offers a tool to help understand the PBLP. The strength of the model is that it provides an image of the overall program and its parts, and it offers a vocabulary to talk about the PBLP program. The recommendation is to use the model to describe, evaluate, manage, and reflect on the total PBLP program as an entity comprised of nine sub-entities.

Patterns Observed

The four diagrams depict consistent observable patterns at work in the PBLP group session. The explicated patterns

provide a springboard for discussion and create a way to understand specific group process phenomena. Like the PBLP Lives Model, these diagrams are primarily used to describe the relationships between PBLP components.

Case Flow

The case flow diagram (see Figure 4) names the major parts of a case and visually depicts their relationship to each other. The arrangement of case parts never changes, but the parts' proximity to each other and the case complexity do change. For instance, in some cases there are multiple complaints that generate multiple diagnoses and multiple treatments. The model, however, can be applied to every case, giving a consistent way to diagram and talk about a case no matter the topic.

Disclosed, the case information flow diagram is useful in a variety of ways to facilitators, director, and students. A facilitator could provide this diagram to students as a review tool by having the students fill in the case information on the diagram. The diagram would then serve to pull two to four days of work together into a tidy package. Posting each diagram in a conspicuous place would serve as a quick and constant reminder of the cases that were done and the issues that had been covered to date.

The diagram could prove useful as a outline for case development teams. Using this model, case writers can quickly fill in the case information on the diagram and visualize how the case story might or work. In a similar way, the diagram could be used by the course director to aid in selecting cases for the quarter. The diagram would make it easy to compare visually cases so a logical sequence of cases can be picked for the quarter. Finally, the diagram could be used in briefings and program documents as a visual aid to help non-PBLers understand how cases are developed and play out over several sessions.

Session Flow

The session flow diagram (see Figure 5) visually depicts the relationship between the students basic science understanding and the case pages distributed over time. The importance of this pattern to facilitators and students becomes evident during the day-to-day struggle seen in group work. Knowing the flow of the session can have several beneficial effects.

Enlarged and posted, the diagram can serve as a daily progress chart. Students could see progress being made and have a visual record of the session. Produced for notes, the diagram could be annotated with page and session information by the facilitator and/or students. Using this

diagram, students and facilitators could learn to anticipate the times of most frustration and so provide the most encouragement then.

By using this diagram as a expectancy tool and history chart, a facilitator can move into a new level of sensitivity to the case, session, and group work. It provides a way to look at a session and suggests a way of describing and documenting a session. Using this diagram can transform a facilitator's experience from passive to active, presenting the potential for very specific and helpful feedback and advice to the group.

Influence Model

It is important to realize that the PBLP group is a living system of self-regulation, interaction, sensing, and feedback. The point is not to master the social science of group behavior, but to understand and call attention to some critical aspects of the group. The model shows the basic interconnected design of the eight people in group (see Figure 6). Although the model suggests equal influence, that is a theoretical equality not seen in practice.

The PBLP program is run under a consensus model which does not identify any formal leaders. Realizing that, along with consideration of the model, allows for some inferences to be made in regard to the PBLP group process. Two primary

deductions are that decisions are consensus driven and sometimes slow in coming, and that there is plenty of opportunity for creativity in the group process concerning influence. I will address each deduction in turn.

Consensus driven groups negotiate, compromise, and try to take everyone's view into consideration. The implications call for each member to decide whether to do nothing, become a negotiator, or join in the negotiations. Often the consensus process works well, but if it breaks down using the influence model could be valuable as a tool to discuss the possibilities of how to improve it.

The influence model also suggests that opportunities abound to develop interpersonal relations, learn leadership and followership, and practice listening. If everyone had a copy of the model it could be used to evaluate perspectives on influence by asking students to annotate how they feel influence works in the group. Finally, it can be used as a facilitator tool to chart, make notes, lead off wrap-up, and tune in to the influence patterns forming within a group.

Confidence Versus Volume Model

The last pattern that surfaced as important to the PBLP process is the confidence versus volume diagram. This is important as a tool for students and facilitators to gauge the confidence of a student's knowledge as they discuss the

case and their learning issues. The recommendation is to be aware of this pattern but use it judiciously because, while the pattern is generally indicative of confidence in what's said, there are times when speakers can sound confident and still not have the right information.

Patterns Observed Summary

The patterns outlined represent a systematic arrangement and design that can be used to depict, describe, plan, review, and exploit. They were produced from a close examination of the PBLP process from a group work and session perspective. Facilitators, students, and directors may use these patterns in a variety of ways as tools to understand and attend to the PBLP process.

Analysis and Interpretation of Formats

Typical Group Session

The group session can be seen as a series of segments, each with special characteristics. Segmenting the session decomposes its complexity and enables definition, judgment, and session management to be informed and focused. Segmenting a session also eases isolating each segment for

analysis of its component parts, so that recommendations can be drawn from its explicit and implicit elements.

Five segments are presented: social chatter, front matter, group work, learning issue discussion, and wrap-up. The segment names are labels created in Chapter IV to provide a way to talk about the session segments. Each segment, analyzed and interpreted in Chapter IV, is presented again for discussion and recommendations in the order they occurred in a session.

Social Chatter

Social chatter is the talk at the beginning of each session prior to the group work on the problem. The tone of the session is often determined by the quantity and quality of the beginning social chatter. This implies that a session can be "primed" to a higher level through the use of social chatter in the form of positive stories, jokes, or encouragement.

Interestingly, the day both facilitators were gone the students were a bit looser with their stories and bit more animated. They started the session with three stories from different students and they went on to have a great session. If the social chatter is at all precedent to a great session the implication is to strive for good social

chatter--not cutting it off too quickly but letting the students have a good time with it before they begin.

Another component of social chatter time that seemed to make a difference was small thoughtful gestures to the group. For instance, on several occasions someone was thoughtful enough to bring in treats for everyone, and this made for a better session. The idea is, the time of social chatter promotes interpersonal relations that improves group bonding and productivity. Knowing that provides an opportunity to attend consciously to and facilitate social chatter, not in a directive way, but in a way that is inclusive and purposeful.

Front Matter

Front matter is a segment of session time devoted to discussing the previous sessions LIs and integrating them back into the patient problem. The important aspects of front matter can be identified as unguided attention and lack of closure on comments and questions. Both impact the direction of the group on the case.

The intent of the curriculum design is to value every group member's insights and contributions. If some members are dominant or non-assertive, their input simply goes unattended. Also, if one or more outgoing students

dominate, other comments and questions get overrun by the dominant student's agenda.

Perhaps this is a leadership problem the group needs to work out for themselves; but knowing about front matter and highlighting it gives facilitators and students the emphasis and vocabulary needed to understand and improve it. The facilitators can play a key role in explicating attention and closure issues and talking about leadership. They can model the kind of leadership they know works for aspects of attention and closure.

A facilitator can also point out and commend high quality examples of good leadership as they appear in session. Encouragement of this nature has a wonderful effect on the group and begets more good leadership. These leadership aspects should be made explicit because they are competencies future doctors will be called on to demonstrate.

Other actions facilitators can take in regard to attention and closure are to note the dominant patterns in the group concerning who is being attended to and who is not. Intervention strategies can be made focused and purposeful if these patterns are known. While it is true that students often become frustrated with facilitators' intervention, this is rarely the case when the points made

are not their own personal agenda but observations about how the group can improve their work.

A good example of the complexity of this problem occurred in the fifth session of the quarter as the facilitators were trying to help the students get started at the beginning of the session. Their help was part of a pattern they had begun to form which frustrated the students. An excerpt from the observations clearly illustrates this struggle.

Case 108 **Session 2 Page 1 observe**

Twyla: [to facilitators] I'm getting frustrated with the questions you're asking because they are off the issue. I don't think they are in line with our learning issues and they take us off on little tangents.

[Observer note: This was said with a good deal of emotion. As I reflect on this incident it is not hard to speculate why it happened. It seems the facilitators have to work out how they will fit into the group and how much the group will tolerate or want from them.]

In the wrap-up of this session Martha, Mel and Dr. Curry commented on Twyla's observation in an attempt to analyze what had happened.

Case 108 **Session 2 Page 1 observe**

Martha: The questions should be directly related to LIIs.

[Observer expanded note: This comment is directed back to the beginning when Amy told the facilitators they were frustrating the process with their questions. I think this could have been avoided if the facilitators had worded their questions differently. Their question asks the students to have a right answer and satisfy their need to know what the students knows.]

Mel: Go for more general then to specific, too much to try for detail early--all these questions

right off the bat makes me feel like we didn't do anything and I know we did--I don't mind being challenged ..

[Observer expanded note: You can hear the frustration in Mel's wrap-up statement about her felt need to answer the facilitator's question. Their intent was to make cause the students to think about specific topics but the way they presented the questions did not ask them to think--just have the right answer.]

Curry: What I try to home in on when I hear that is something that I think you might skip over.

At first glance this may seem like the students don't want the facilitators involved, but it is clear that involvement was not the issue; question focus was. The implication is for facilitators to construct carefully their questions so they are not perceived as pushing their own agenda but rather attempting to help them improve their work.

Finally, to avoid a lack of closure facilitators can note who and what is getting pre-preempted. In that way the facilitator can use his or her notes as fodder during wrap-up, increasing group sensitivity to each other and highlighting important points getting overrun. Thinking about front matter in terms of attention and closure allows for the development of a plan to improve the PBLP process, avoids unnecessary student frustration, and gets facilitators proactively involved in these important areas of the groups work.

Group Work

Group work is the third segment of a typical session and refers to the intense time of working through the problem. Four topics emerge as important and consequently provide areas for discussion and recommendation: (a) case presentation, (b) "the hunt," (c) "the call," and (d) the case story line. These topics serve as a catalyst for the group's work, and if done well, make sessions more productive.

Case Presentation

Case presentation refers to the transitional step from front matter to group work. This step entails a case synopsis delivered by the previous day's scribe. A good quality presentation delivered with confidence and energy perks up the group and lays the foundation for the group's work for the rest of the session. Without a good presentation the group flounders, not knowing where they are in the case, and struggling to move forward.

Knowing that poor presentation affects the quality of the group session suggests that some strategies are needed to ensure good presentations. One way may be to require all the students to be prepared to present, and then pick one at random. If every student is prepared to present, then every

student has thought through the case, and discussion is enhanced. Another strategy would be to model a presentation for them or to invite the case author in to "present". The students would then have an opportunity to "see" the practitioners rendition of the case and ask any questions that weren't answered by the case information.

Two other strategies come to mind. A facilitator could forgo the automatic assignment of the scribe as presenter and re-assign a student who is not well prepared to re-present or prepare the next presentation. The facilitator and other group members could also take time to critique the presentation.

Presenting is an important skill of the practicing professional. Also, presenting requires the cognitive work of reflection, review, and verbalization while it give the group opportunity for challenging and establishing a consensus of the case facts to date. Realizing how the case presentation affects the individual and the group provides the justification, making it a more explicit activity done with the proper emphasis and quality.

"The Hunt" and "The Call"

Two properties of group work highlighted by the study are "The Hunt" and "The Call". "The Hunt" refers to the work group members do in session searching for relevant case

data in the resource books on hand. "The Call" is a term used to describe how students ask for case information.

Once noted, students and facilitators can make informed decisions about when to move forward on the case, when to request or hand out a new page, and when to be still and let silent searching or contemplation rule. Knowledge of and sensitivity to these elements of group work give students and facilitators a vocabulary to use in deciding how to shape their time in session.

The Case Story Line

A PBLP case is really a historical rendering of an actual case. Therefore, cases can be thought of as a story. Since much of our learning is associated with stories, thinking about a case as a story can be useful.

One implication is that facilitators can be seen as the story masters. Viewed as such, facilitators should know every aspect of the story in detail and use it as a tool to ask "what if" questions. In addition, students can be viewed as detectives searching for clues to solve the mystery.

Conceptualizing cases as stories suggests looking at each case to determine their interest, depth, breadth, and relevance to other cases. Cases could be written to have multiple tracks and be amenable to multiple endings. Story

(case) authors could be invited for a round table discussion after it has been completed. The strategies from this analogy provide ways to build cases in different ways to keep the PBLP process fresh and exciting.

Group Work Summary

The majority of session time is spent in group work. Continuous observation of this work yielded four recurring events labeled presentation, the hunt, the call, and the story line. By explicating these implicit workings of group work, a discussion is possible about ways to exploit them in the PBLP program. Besides the opportunities these group work events provide, each is a stepping off point for future research.

Identifying Learning Issues (LIs)

It is important for students to identify their own learning issues. The PBLP curriculum rests on the premise of developing students who construct their knowledge from a self-identified need to know, and learn the habit of taking responsibility their learning. Identifying learning issues in a typical session models this process.

The main theme of LI identification during session is the process of negotiation to select certain LIs for

independent study. LIs are identified throughout the session, but before the group disbands they collectively choose some or all of the LIs to study independently. Choosing LIs is a necessary part of the PBLP process. Isolating this segment of the group session for discussion provides a way to make recommendations about the process that may be helpful to the participants.

One strategy could be for a facilitator to assume the role of scribe for the process. The scribe is often in an awkward position during the LI vote because they hold "the power of the chalk." If facilitators took this role they could be totally neutral, giving all the students the same voice.

Another possibility for facilitator action is keeping track of the LIs not picked to check for later coverage. This type of "list making" activity would help a facilitator track and remember the groups thinking and possibly point out the relevance of a previously passed over LI. Even though the selection of LIs is the student's business, facilitators can help if they know how the process works and are given some strategies to use.

Wrap-up

According to the PBLP process outlined in the program documents, the wrap-up is an essential part of group work.

Wrap-up is designed to be a time for the group to evaluate their efforts and make recommendations on how to improve their performance. Observations revealed that this debriefing process was usually led by the facilitators and was weak at providing the kind of feedback necessary for growth in group functioning.

Studying the group session process revealed several problems concerning wrap-up. In almost every session it was observed that a "how'd we do" question got an "Okay" answer, and not much more. Looking specifically at wrap-up allows for a discussion of strategies to make wrap-up "work."

A good start might be to orientate thoroughly the group on wrap-up expectations and timing. Many underlying concerns never surfaced at wrap-up because there wasn't sufficient time. Also, expectations have not been developed based on an insistence and example of nonattribution required for this type of activity.

Specific open ended questions are best for eliciting the kind of feedback that allows members to think about and then speak out on their group process. Some understanding of question dynamics can go a long way in promoting good feedback. Questions that can be answered with a "yes," "no," or "okay" are not the type of questions that will provide anything substantial to the improvement of the group process.

Thinking about wrap-up generates several other ideas to make it function as it is intended:

1. Have students and facilitators note their comments and concerns throughout the session for wrap-up. (This is a good suggestion for facilitators even if it isn't used for wrap-up.)
2. Make session feedback a part of the students' independent study and start the session with feedback from the previous session.
3. Ask the students to keep a journal about ideas concerning how the group is functioning and periodically discuss their entries at wrap-up or privately.

These ideas, or variations of them, can at least be tried, in order to see if they make a difference to the wrap-up process.

One strategy shared by a student is to have a time of encouragement. Encouraging feedback is just as important, probably more so, than problem feedback. The major point, however, is that feedback must be specific to be meaningful, and that rarely occurred during the last minute rush to check the wrap-up block within our group.

Wrap-up has the potential for real meaningfulness if carefully attended to. Facilitators need to model good feedback and solicit it from the group. The wrap-up is an important part of the PBLP group session process but its potential can only be realized through purposeful, proactive efforts.

Typical Group Session Summary

One of the delightful things about decomposing the PBLP group session into social chatter, front matter, group work, learning issue identification, and wrap-up is the liberation from the complexities of the session as a whole. Isolation of session segments facilitates discussion and recommendations. The recommendations serve as a primer for thinking about the PBLP process, and ways to study and improve it.

Key Elements of the PBLP Experience

The six key elements of the PBLP offer yet another window into areas open for discussion and recommendations. The importance of these elements have been outlined in Chapter V. The discussion that follows is focused on implications of those elements, including group bonding, coverage, frustration, leadership, humor, and student perceptions of the PBLP experience. Each element is presented in turn and recommendations are provided.

Group Bonding

Bonding is a human emotional term concerning the amount of support and empathy individuals have for each other. It is sometimes referred to as group cohesiveness and it

greatly affects a group's productivity. Bonding is important to group work, especially early in the quarter.

Bonding results in fewer disagreements, less awkward silence, more comfort with the group, ability to relate personally, and camaraderie. Normally, bonding occurs incrementally, starting with the first meeting, and grows as the group has experiences together. The implications from the research data on bonding confirm a direct relationship between bonding and effective group work, suggesting the sooner and the more bonding that occurs, the better.

The overriding recommendation is to make bonding a group priority by making it explicit, providing for bonding opportunities, and being sensitive to it throughout the quarter. One way to accomplish that is to make bonding a group goal by talking about it as such, and to share success stories from examples of groups that bonded well and those that did not.

Some of the best times for the group were before and after session. Knowing this suggests that groups should be encouraged to arrive early and talk informally after session, and try to arrange for informal gatherings early in the quarter and several times during the quarter. The home cooked pizza night and group picnic our group experienced had an almost magical effect on our group at the following

session. Everyone was more relaxed with each other, ideas and questioned flowed, and there was much laughter.

Facilitators are in a good position to know how group bonding is going and to ask students to write privately about what they think, and to encourage them to share about this during wrap-up. Not surprisingly, the journal writing students often speculated about their personal feelings, and in the cases in which they brought up their feelings at wrap-up they found that a majority of the group felt the same way. If a facilitator understands this idea of group bonding, attends to it, and takes action, everyone benefits.

Coverage

Coverage is a term used by the participants to describe their selection of use of resources. It is also used to talk about their breadth and depth of LI selection in terms of the seven science disciplines and seven organizational levels (see Table 13). In the context of their work it is not hard to know which meaning they imply when they use the term. But it is useful to explicate the fact that coverage has dual meanings--both generating different recommendations.

Much of their group work consisted of discussion about resource findings. Therefore, the students were interested in the resources used by others, if they came to the same

understanding, if they found a particularly relevant source, and if they read part or all of a source. These interests were consistently verbalized and provided the focus for much discussion. Communication is the main strategy to satisfy these interests.

Communication is needed to help students with the coverage dilemma. The communication can take many forms. A short "court" report asking students to report quickly on what they studied, what resources they used, and how they liked them would alleviate much of the front matter guess work. This could take the form of a resource data bank for students and facilitators with a history of what was done before, or some form of written lists by students on their research strategies. Any of these suggestions could be offered as a resource for immediate use or as historical aids.

LI breadth and depth coverage is also a communication problem. One way to solve this might be to create an issues overview chart showing the basic medical knowledge that is expected to be covered. The chart could be based on what the LD students get, or from the PBLM LI list. Throughout the quarter, they might fill in the chart with the LIs covered. Visually depicting coverage in this way would give the group a clearer indication of LI coverage.

Other strategies for both concerns are to invite a graduate of the program to speak about these concerns based on hindsight. The Medical Board Exams are indicative of coverage, as is keeping track of prior students' and other PBL programs students test scores to provide evidence of coverage. In our group, Dr. Curry handed out a Medical Board Exam booklet identifying the topics on the exam. Even though the list of topics was quite overwhelming, it allowed the students to get an idea of what is expected and some measure of how their experience fit that expectation.

Each strategy offered is aimed at communicating. Being alerted to coverage and its multiple meanings provides opportunities to address this issue proactively. This could make a significant difference in the group's experience of the PBLP.

Frustration

Frustration primarily results from a hindrance of attaining a goal or purpose. While it is generally considered negative, in the PBLP setting it often serves as a form of motivation to learn. There is not much a facilitator can do about a student's frustration at the beginning of a new case or with her frustration over her apparent lack of knowledge, but there are ways of relieving

the stressful aspects of frustration that let it work for students instead of against them.

One way to alleviate frustration is to know that others share the same frustrations. The implication is to make this a regular debriefing topic. This opens the door for others to share and provides a time of encouragement.

In my research group several students mentioned that they knew it must be frustrating to be a facilitator, but the facilitators never made their struggle explicit. If they had, that might have given the group licence to air their frustrations. Kirk said that writing his journal gave him an outlet to figure out his frustration. He knew he was feeling frustrated about the group, but didn't know why until he wrote about it. Writing a journal could be another strategy to deal with the constant frustration. Journal entries can then be used creatively in wrap-up to discuss this aspect of the PBLP.

Another strategy is to remind the students that, while it is not going to go away, frustration is a normal part of the curriculum and should be thought of as the student's friend. Reminding them of the big picture, and guiding them in seeing frustration for what it really is, seems like a simple but useful strategy. Awareness of this implicit attribute of the PBLP provides the impetus to make it helpful, not hurtful.

Leadership

There are many different kinds of leadership styles, positions, and attributes. The problem with leadership in the PBLP is that there is none, at least in the sense that there are no formally assigned leadership roles. The data suggests that even if explicit roles are not assigned, the topic and understanding of group and session leadership is needed.

There are many ways to infuse leadership in the PBLP. First it must be made an explicit goal of the program to develop leadership traits and experience in the students. As future doctors, they will have to assume leadership responsibilities. The strategies for developing leadership can start with creating an explicit group role of leader for the day, or for the case. It would be appropriate to identify several leadership roles such as supporter, recorder, clarifier, initiator, or encourager, and assign those on a daily or case basis.

Two other ways leadership can be introduced into the program is through program orientation and facilitator modelling. If facilitators sense a problem in this area it should first become a topic of wrap-up discussion and then dealt with in some way. Facilitators need to describe their perceptions of leadership in order to bring it to a conscious level and to provide an opportunity for the group

to decide if something is needed. Whatever is decided, it should be a group decision and it should be explicit.

Humor

Humor was said to bridge the gap, break the ice, bond the group, relieve tension, and serve as a barometer for how a group is working. The power and affect of humor should be understood and exploited. While employing humor is easier said than done, some strategies can be thought about and acted upon.

Many times humor comes spontaneously from certain members of the group. One scheme is to encourage that and talk about its effect at wrap-up. By talking about the role of (appropriate) humor during wrap-up, it can be promoted and let students know it's okay to laugh.

Understanding that humor does good things to the group should make every student and facilitator a humor collector and connoisseur: always be on the look-out for comics and non-offensive jokes; ask colleagues for their best comic view graphs and start a collection; encourage a hunt for case appropriate cartoons as students do their resource search or read the paper; keep a journal of the humorous moments of group experience to share; make it explicit that it is everyone's job to do everything they can to have some

fun. As Mel said, "if it's more fun, if you can laugh, it makes medical school not such a chore" (Mel_jrnl.doc, p. 4).

Students Perceptions of the PBLP Experience

This is less of a key element and more of a final question to enable students to be provide their words in describing the PBLP. Students liked the program and said its strengths were holistic, active, social, and enjoyable. This is not surprising since these students self-selected into the program. But these comments do explicate what the students think are the PBLP strengths and these can be exploited. Thinking about ways to capitalize on these strengths should be a regular activity.

Regularly remind the students about these strengths. The daily pressure to keep up and press on can be partially alleviated by bringing these positive attributes to a conscious level. Thinking positively begets positive thoughts, and positive thoughts reap a harvest that can only benefit all involved..

Key Elements Summary

The six key elements of the PBLP experience illuminate what can be considered LIs for the PBLP participants, whether they are director, facilitator, or student. The

recommendations presented represent seed ideas that flow from the analysis of data, but they are not full or complete. These elements explicate areas of the PBLP curriculum that the data show need attention. Understanding their influence on the group creates an opportunity to be proactive in ways that were not possible before the study.

Future PBL Research

PBL is relatively young as a curriculum design. For maturation to occur there are many areas of both specific and general research studies needed. Since most of the PBL research is made up of quantitative studies, there is a need for much more qualitative research that tells about PBL as it exists in context. Ideas for specific qualitative or quantitative studies can be seen throughout this study.

The literature review chapter provides seven major PBL issues: group processes, self-directed learning, assessment, facilitators, curriculum structure, problem development, and resources. Although revealed, these issues need research to understand them in relationship to problem-based learning. Within each major PBL issue are a myriad of research projects.

Providing a springboard for future research, each of the four interpretation formats in this study contain topics that can be the subject of study. For instance, the PBLP

"group life" from the PBLP Lives Model can be studied independently or in relation to the other "lives." The other eight PBL "lives" can be studied as well.

The pattern diagrams suggests both ideas for research topics and a strategy for making sense of complex scenes. Research on the influence at work within a PBLP group between students and facilitators, and students with other students, is needed to understand how to take advantage of the potential created by that model. Research should be done concerning the level and type of involvement a facilitator has with the group.

The typical group session provides five segments of the PBLP group process that could be used individually or collectively for a research study. For example, discussion of front matter, when the group discusses the previous sessions LIs, would be a good topic for study because of the need to streamline that process and to make the group's work more meaningful to the participants. Since the students only meet for nine hours each week, making the most of that should be a constant striving and research can inform that goal.

The six key elements also provide six topics where more research is needed. The role and importance of those topics need to be understood since they arise as primary to the group process. For example, it would be useful to know more

about the role of group bonding to the PBLP process. Experimentation or observation could be used to study this relationship. All of the elements need to be researched individually to understand their functions within the program.

PBL needs long term research to determine if PBL is in fact producing a more desirable professional who continues on with a pattern of life-long learning. Research is also needed to compare the PBLP practice to actual practicing doctors, to see what qualitative exist between the education method and the practice. A study aimed at the development of a professional practitioner would be most appropriate to boost confidence in the curriculum design.

Finally, the PBLP exists for developing a medical professional. It is designed to prepare future professionals with more than simply a stock of medical knowledge; but habits of the mind--the students learn how to learn. Any research designed to develop and improve the relationship between learning and the PBL curriculum would be appropriate. PBL is a curriculum design that moves education closer to the actual practice it serves. Research to bridge that gap is appropriate.

Final Recommendation

Watching a PBLP group do their work over an extended period highlighted the difficult position of PBL facilitators. The facilitators in the PBLP, and PBL in general, are charged with overseeing, tutoring, and guiding groups of students who are charged with overseeing, tutoring, and guiding themselves. The design creates a dilemma for both students and facilitators about the type and level of involvement facilitators should have.

There are no easy answers to the question of how much a facilitator should do--it depends. Facilitators must constantly make judgements about the group, individuals in the group, cases, and themselves. These judgments are based on qualities perceived through observation and participation, much the same as this research. The problem might be that facilitators have no explicit method for their "data analysis."

The solution is to provide facilitators with a method to process their PBL data into findings that are useful. The recommended strategy to accomplish this is through facilitator professional development using problem-based learning. This would turn problem-based learning back upon itself as a way to "double" learn the qualities that can be helpful for making informed judgments.

Establishing facilitator professional development using problem-based learning would allow networking among facilitators and provide a forum for indoctrinating new facilitators. An expert facilitator could lead the group using problems from the group members who are facilitating a group themselves. Their learning issues would be based on their own struggles and would allow them to use the group to help work them out.

The dilemma concerning level of involvement can be diminished through providing facilitators with an opportunity to explicitly use the PBL process to reflect on the PBL process. The result will be the development of expert facilitators who can make judgements with confidence.

Study Summary and Conclusion

The discussion and recommendations of this study are the result of an inductive process that attempts to answer the questions: (a) What are the important design characteristics of the PBLP curriculum? and (b) What are the key elements of experience for students in the PBLP? To study either the group or the curriculum without the other would take both out of context and eliminate any chance of an accurate rendering of either. The process of searching the literature, establishing an elaborate study methodology, and

describing the setting and participants provided the boundaries for placing the findings in context.

The study findings are organized into four formats:

a diagrammatical depiction the PBLP showing the nine entities ("lives") that make it up-- assessment life, resource life, group life, individual life, session life, case life, page life, question life, and learning issue life;

four diagrammatical depictions of consistent observable patterns at work in the PBLP curriculum and group work--case flow, session flow, influence model, and confidence versus volume model;

a typical group session with identifiable segments described as social chatter, front matter, group work, identifying learning issues, wrap-up, and back matter; and

six key elements concerning group work in the PBLP--group bonding, coverage (LI depth and breadth, and resources used), frustration, leadership, humor, and students perspective on the PBLP process.

The findings make explicit issues of the PBLP curriculum and group experience that existed but were implicit.

Defining what the implicit curriculum is, McCutcheon (in press) says,

[s]tudents ... have access to implicit learning, which may be intended or unintended but arises out of and is inherent in the everyday nature of classroom life or life in a school. Because schools, classrooms, and educational materials have particular qualities, students have opportunities to learn things emanating from the nature of those schools, classrooms, and materials. (p. xvii)

The findings describe those "particular qualities" and provide a vocabulary for use in description and making recommendations.

Each interpretation format becomes a communication tool, a way to talk about the problem-based learning process in new ways. Each allows the study to transfer to the broader domain of problem-based learning programs in other locations, fields of study, and formats. The tools identify ways PBL directors, facilitators, and students can take proactive measures to evaluate and improve the PBL process.

APPENDIX A
PROBLEM-BASED LEARNING MODULE

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AVAILABLE UPON REQUEST

List of References

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